CONCRETE
AND
CONSTRUCTIONAL ENGINEERING

INCLUDING PRESTRESSED CONCRETE

AUGUST 1961 **VOL. LVI. NO. 8**

FIFTY-SIXTH YEAR OF PUBLICATION

PRICE 2s. ANNUAL SUBSCRIPTION 24s. POST FREE. $3.00 in Canada and U.S.A.

LEADING CONTENTS

	PAGE
"Concretor's Hands"	265
A Practical Comprehensive Method of Designing Reinforced Concrete Sections.—III *By J. Rygol, B.Sc.(Eng.)*	267
Book Reviews	280
A Prestressed Concrete Frame Bridge at Cambridge	281
Multiple-storey Flats at Woolwich	290
Data for Pricing Reinforced Concrete	296

No. 645 ISSUED MONTHLY Registered for Canadian Magazine Post

BOOKS ON CONCRETE For Catalogue of "Concrete Series" books on concrete and allied subjects, send a postcard to:

CONCRETE PUBLICATIONS LTD., 14 DARTMOUTH ST., LONDON, S.W.1.

INDEX OF ADVERTISERS

	Page
A.B. Mould & Construction Co. Ltd.	xiv
A.C.E. Machinery Ltd.	xv
Aberdon & Co. (Engineers) Ltd.	—
Allam, E. P., & Co. Ltd.	xlvii
Allied Building Commodities	—
Atlas Stone Co. Ltd.	—
Barvis, A. & C. Ltd.	—
Berry's Engineering Co.	xxvii
Boulder Equipment Ltd.	—
Bover, Wm., & Sons Ltd.	xliv
Braithwaite & Co., Engineers Ltd.	—
B.R.C. Engineering Co. Ltd.	lvi, lx
Brett, Robert, & Sons Ltd.	—
British Oxygen Co. Ltd.	—
British Steel Piling Co. Ltd.	—
Building & Construction Co. Ltd.	—
Byrd, A. A., & Co. Ltd.	xlix
Cable Covers Ltd.	lii
Caledonian Mechanical Handling Co. Ltd.	—
Caplin Engineering Co. Ltd.	xxviii
Castlehill Sand & Gravel Co. Ltd.	—
Cement Marketing Co. Ltd.	xxxviii
Cement & Steel Ltd.	iv
Chrethan, Alex. J., Ltd.	xxxii
Chemical Building Products Ltd.	xxx
Christiani & Nielsen Ltd.	—
Cohen, George, Sons & Co. Ltd.	—
Colcrete Ltd.	xxv
Concrete Piling Ltd.	—
Concrete Flooring Co. Ltd.	xx
Concrete Pump Co. Ltd.	xxii
Conveyancer & Co. Ltd.	xvi
Costain Concrete Co. Ltd.	—
Cowlin, Wm., & Son Ltd.	—
Croydon Reinforced Fibreglass Co.	xii
D.A. Models Ltd.	vi
Dandridge, J. & A., Ltd.	—
Davidson's Paper Sales Ltd.	—
De Jong	viii
Dickens, Stuart B., Ltd.	xxxix
Dorman Long & Co. Ltd.	—
Douglas, Robert M. (Contractors) Ltd.	—
Duratube & Wire Ltd.	—
Engineering Design & Construction Ltd.	xiii
Expandite Ltd.	—
Farr, A. E., Ltd.	—
Flexible Drive & Tool Co. Ltd.	xvi
Ford Motor Co. Ltd.	xvii
Frankipile Ltd.	—
G.K.N. Reinforcements Ltd.	lv
Gleeson, M. J. (Contractors) Ltd.	—
Goodes Engineering Ltd.	—
Gunite Construction Co. Ltd.	xxxii
Hall & Co. Ltd.	—
Hilton Gravel Ltd.	—
Holmpress Piles Ltd.	—
Holst & Co. Ltd.	—
Huntley & Sparks Ltd.	xliv
Ideal Casements (Reading) Ltd.	—
Imperial Chemical Industries Ltd.	—
Johnson, Richard, & Nephew Ltd.	xxxi
Jones, T. C., & Co. Ltd.	—
Kerner-Greenwood & Co. Ltd.	xxxiii
Kirr, J. L., & Co. Ltd.	xi
King, J. A., & Co. Ltd.	xlviii
Lafarge Aluminous Cement Co. Ltd.	liv
Lawler Avers & Co. Ltd.	—
Laws & Son (Stains) Ltd.	—
Leca (Great Britain) Ltd.	—
Leeds Oil & Grease Co. Ltd.	xx
Lenscrete Ltd.	xxxvi
Leverton (Industrial) Ltd.	—
Lillington, George, & Co. Ltd.	xliii
Lind, Peter, & Co. Ltd.	vii
Longden, George, & Son Ltd.	—
McCall & Co. (Sheffield) Ltd.	xxi
McCalls Macalloy Ltd.	xii
McKinney Foundations Ltd.	—
Machinery (Continental) Ltd.	—
Masonite Ltd.	xxix
Masser, A. H., Ltd.	—
May & Butcher Ltd.	xxiv
Milbank Floors Ltd.	xiii
Millars' Machinery Co. Ltd.	liii
Mills Scaffold Co. Ltd.	xxxiv, xxxv
Modular Concrete Co. Ltd.	li
Monk, A., & Co. Ltd.	—
Mulcaster, Wm., & Co. (Contractors) Ltd.	xxxvi
Myers, Fred, Ltd.	—
Omnia Constructions Ltd.	—
P.S.C. Equipment Ltd.	xviii, xix
P.Z. Prestressing Co. Ltd.	ix
Passbley & Trickett Ltd.	—
Pitman, Sir Isaac, & Sons Ltd.	—
Portasilo Ltd.	xlviii
Powell Duffryn Timber Industries Ltd.	—
Prestressed Sales Ltd.	—
Priest, B., & Sons Ltd.	xii
Pumpcrete Hire Co. Ltd.	xl
Ranalah Steel Moulds Ltd.	xlv
Rover Car Co. Ltd.	—
Rush & Tompkins Ltd.	—
Rylands Brothers Ltd.	—
Sealocrete Products Ltd.	x
Sharp Jones & Co. Ltd.	—
Simplex Concrete Piles Ltd.	—
Somerset Wire Co. Ltd.	lv
Stelmo Ltd.	l
Stent Precast Concrete Ltd.	—
Stic B Paint Sales Ltd.	—
Stone Court Ballast Co. Ltd.	—
Storer, Wm. T., & Co. Ltd.	xxvi
Stressing Developments Ltd.	xxiii
Stuart's Granolithic Co. Ltd.	xlvi
Sussex & Dorking Brick Cos. Ltd.	—
Tarmac Ltd.	—
Technical Paint Services	—
Tentor Bar Co. Ltd.	lix
Thames Plywood Manufacturers Ltd.	—
Tileman & Co. Ltd.	—
T.P. Polyplastic Converters Ltd.	—
Trent Gravels Ltd.	xliv
Triton Engineering Co. (Sales) Ltd.	v
Truck-Mix (Midlands) Ltd.	—
Tunnel Portland Cement Co. Ltd.	—
Unistrut Division of Sankey-Sheldon Ltd.	—
Volkmann, O. A.	—
Walker Wright & Co. Ltd.	—
Welbeck Trading Co. Ltd.	xxxvii
Wellerman Bros. Ltd.	—
Westwood, Joseph, & Co. Ltd.	—
Whitecross Wire Co. Ltd.	—
Whitehead Iron & Steel Co. Ltd.	—
Whitley Moran & Co. Ltd.	—
Wilson, Roy, Dickson Ltd.	iii
Winget Ltd.	—
Wolf Electric Tools Ltd.	—
Yorkshire Hennebique Contracting Co. Ltd.	—

SULPHITE LYE

FOR IMPROVED CONCRETE QUALITY

IN LIQUID FORM

CALCIUM BASE SULPHITE LYE ▶ **CEMENT DISPERSER**

is the most effective and economical material for producing air-entrained and colloidal concrete, and will satisfy the most exacting requirements for this class of work. It is available in any desired quantity—large or small—for contracts in any part of the country.

SODIUM BASE SULPHITE LYE ▶ **CEMENT EXPANDER**

The sodium-base type of Sulphite Lye is highly recommended by leading Reinforced Concrete Engineers as an effective cement expander for the construction of concrete dams and foundations, and also for use in grouting prestressing cable ducts.

Free samples, prices, and full details will be sent on request

SUPPLIED AT SHORT NOTICE IN DRUMS OR ROAD TANK WAGONS

ROY WILSON, DICKSON LTD

41 NORTH JOHN ST, LIVERPOOL 2 *Tel: Central 7691*

A

INDEX OF ADVERTISERS

	Page
A.B. Mould & Construction Co. Ltd.	xiv
A.C.E. Machinery Ltd.	xv
Abelson & Co. (Engineers) Ltd.	—
Allan, E. P., & Co. Ltd.	xlvii
Allied Building Commodities	—
Atlas Stone Co. Ltd.	—
Barvic, A. & C. Ltd.	—
Berry's Engineering Co.	xxvii
Boulder Equipment Ltd.	—
Bover, Wm., & Sons Ltd.	xliv
Braithwaite & Co., Engineers Ltd.	—
B.R.C. Engineering Co. Ltd.	lvi, lx
Brett, Robert, & Sons Ltd.	—
British Oxygen Co. Ltd.	—
British Steel Piling Co. Ltd.	—
Building & Construction Co. Ltd.	—
Byrd, A. A., & Co. Ltd.	xlix
Cable Covers Ltd.	lii
Caledonian Mechanical Handling Co. Ltd.	—
Caplin Engineering Co. Ltd.	xxviii
Castlehill Sand & Gravel Co. Ltd.	—
Cement Marketing Co. Ltd.	xxxviii
Cement & Steel Ltd.	lv
Cheetham, Alex. J., Ltd.	xxxii
Chemical Building Products Ltd.	xxx
Christiani & Nielsen Ltd.	—
Cohen, George, Sons & Co. Ltd.	—
Colcrete Ltd.	xxv
Concrete Piling Ltd.	—
Concrete Proofing Co. Ltd.	xx
Concrete Pump Co. Ltd.	xxii
Conveyancer & Co. Ltd.	xvi
Costain Concrete Co. Ltd.	—
Cowlin, Wm., & Son Ltd.	—
Croydon Reinforced Fibreglass Co.	xii
D.A. Models Ltd.	vi
Dandridge, J. & A., Ltd.	—
Davidson Paper Sales Ltd.	—
De Jong	viii
Dickens, Stuart B., Ltd.	xxxix
Dorman Long & Co. Ltd.	—
Douglas, Robert M. (Contractors) Ltd.	—
Duratube & Wire Ltd.	—
Engineering Design & Construction Ltd.	xiii
Expandite Ltd.	—
Farr, A. E., Ltd.	—
Flexible Drive & Tool Co. Ltd.	xvi
Ford Motor Co. Ltd.	xvii
Frankipile Ltd.	—
G.K.N. Reinforcements Ltd.	iv
Gleeson, M. J. (Contractors) Ltd.	—
Goodes Engineering Ltd.	—
Gunite Construction Co. Ltd.	xxxii
Hall & Co. Ltd.	—
Hilton Gravel Ltd.	—
Holmfirth Piles Ltd.	—
Holst & Co. Ltd.	—
Humfrey & Sparks Ltd.	xliv
Ideal Casements (Reading) Ltd.	—
Imperial Chemical Industries Ltd.	—
Johnson, Richard, & Nephew Ltd.	xxxi
Jones, T. C., & Co. Ltd.	—
Kerner-Greenwood & Co. Ltd.	xxxiii
Kier, J. L., & Co. Ltd.	xi
Kirk, J. A., & Co. Ltd.	xxviii
Lafarge Aluminous Cement Co. Ltd.	liv
Lawler Ayers & Co. Ltd.	—
Laws & Son (Stainer) Ltd.	—
Leca (Great Britain) Ltd.	—
Leeds Oil & Grease Co. Ltd.	xx
Lenocrete Ltd.	xxxvi
Leverton (Industrial) Ltd.	—
Lillington, George, & Co. Ltd.	xliii
Lind, Peter, & Co. Ltd.	vii
Longden, George, & Son Ltd.	—
McCall & Co. (Sheffield) Ltd.	xxi
McCalls Macalloy Ltd.	xii
McKinney Foundations Ltd.	—
Machinery (Continental) Ltd.	—
Masonite Ltd.	xxix
Massey, A. H., Ltd.	—
May & Butcher Ltd.	xxiv
Milbank Floors Ltd.	xiii
Millars' Machinery Co. Ltd.	liii
Mills Scaffold Co. Ltd.	xxxiv, xxxv
Modular Concrete Co. Ltd.	li
Monk, A., & Co. Ltd.	—
Mulcaster, Wm., & Co. (Contractors) Ltd.	xxxvi
Myers, Fred, Ltd.	—
Omnia Constructions Ltd.	—
P.S.C. Equipment Ltd.	xviii, xix
P.Z. Prestressing Co. Ltd.	ix
Pashley & Trickett Ltd.	—
Pitman, Sir Isaac, & Sons Ltd.	—
Portasilo Ltd.	xlviii
Powell Duffryn Timber Industries Ltd.	—
Prestressed Sales Ltd.	—
Priest, E., & Sons Ltd.	xii
Pumpcrete Hire Co. Ltd.	xi
Rapalam Steel Moulds Ltd.	xiv
Rover Car Co. Ltd.	—
Rush & Tompkins Ltd.	—
Rylands Brothers Ltd.	—
Shallocrete Products Ltd.	x
Sharp Jones & Co. Ltd.	—
Simplex Concrete Piles Ltd.	—
Somerset Wire Co. Ltd.	lv
Steelmix Ltd.	l
Stent Precast Concrete Ltd.	—
Stic B Paint Sales Ltd.	—
Stone Court Ballast Co. Ltd.	—
Stother, Wm. T., & Co. Ltd.	xxvi
Stressing Developments Ltd.	xxiii
Stuart's Granolithic Co. Ltd.	xlvi
Sussex & Dorking Brick Co. Ltd.	—
Tarmac Ltd.	—
Technical Paint Services	—
Tenton Bar Co. Ltd.	lix
Thames Plywood Manufacturers Ltd.	—
Tileman & Co. Ltd.	—
T.P. Polyplastic Converters Ltd.	—
Trent Gravels Ltd.	xliv
Triton Engineering Co. (Sales) Ltd.	v
Truck-Mix (Midlands) Ltd.	—
Tunnel Portland Cement Co. Ltd.	—
Unistrut Division of Sankey-Sheldon Ltd.	—
Volkmann, O. A.	—
Walker Wright & Co. Ltd.	—
Wellbeck Trading Co. Ltd.	xxxvii
Wellerman Bros. Ltd.	—
Westwood, Joseph, & Co. Ltd.	—
Whitecross Wire Co. Ltd.	—
Whitehead Iron & Steel Co. Ltd.	—
Whitley Moran & Co. Ltd.	—
Wilson, Hoy, Dickson Ltd.	liii
Winget Ltd.	—
Wolf Electric Tools Ltd.	—
Yorkshire Hennebique Contracting Co. Ltd.	—

SULPHITE LYE

FOR IMPROVED CONCRETE QUALITY

IN LIQUID FORM

CALCIUM BASE SULPHITE LYE ▶ **CEMENT DISPERSER**

is the most effective and economical material for producing air-entrained and colloidal concrete, and will satisfy the most exacting requirements for this class of work. It is available in any desired quantity—large or small—for contracts in any part of the country.

SODIUM BASE SULPHITE LYE ▶ **CEMENT EXPANDER**

The sodium-base type of Sulphite Lye is highly recommended by leading Reinforced Concrete Engineers as an effective cement expander for the construction of concrete dams and foundations, and also for use in grouting prestressing cable ducts.

Free samples, prices, and full details will be sent on request

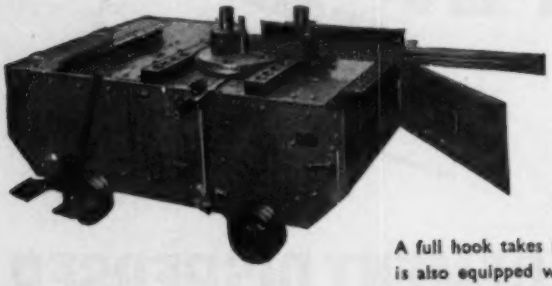
SUPPLIED AT SHORT NOTICE IN DRUMS OR ROAD TANK WAGONS

ROY WILSON, DICKSON LTD

41 NORTH JOHN ST, LIVERPOOL 2 *Tel: Central 7691*

A

BAR-BENDING EQUIPMENT

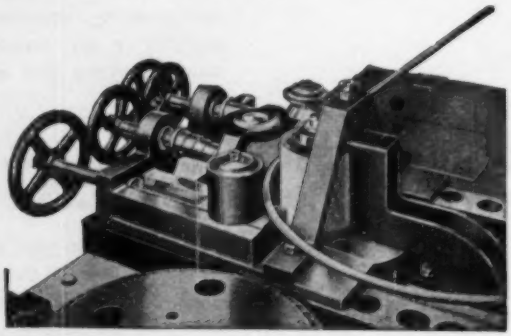


RAS.40 MODEL

This is a single-disc machine which is specially designed for an extraordinarily high rate of bending bars up to 1¼ in. diameter. A full hook takes three seconds' bending time. It is also equipped with accessories for bending angle loops in one operation on mild steel reinforcement up to 1 in. diameter.

HOOPS & SPIRALS

We supply, at extra cost, an appliance (illustrated here) for use with RAS.40 and ARD.50 models for the bending of hoops and spirals. Bends radii of 11 in. and upwards and to any pitch of spiral.



Our Bending Equipment also includes the ARD.50 model—a double-disc machine for bending bars up to 2 in. diameter. We also supply, at extra cost, formers and backrests for special steel such as "Square Grip," "Twisteel," etc., which can be fitted to the ARD.50 and RAS.40 models. Full details are available on request. All machines are available for Sale or Hire.

CEMENT & STEEL, LTD., SECOND AVENUE, CHATHAM, KENT

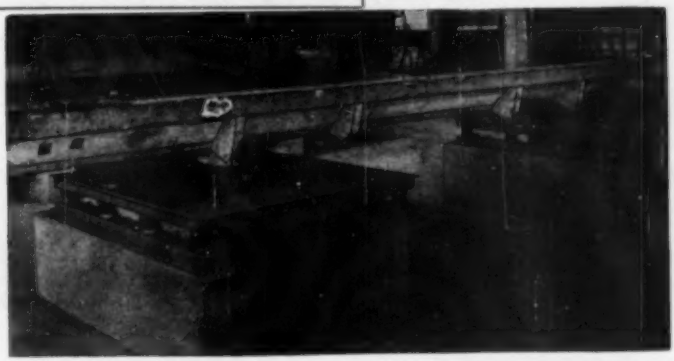
Telephone: Chatham 45580. *Telegrams & Cables:* Cambelgi, Chatham

TRITON

REGD TRADE MARK

VIBRATING SYSTEMS FOR PRECAST CONCRETE WORK ON THE SITE

Triton vibrating systems provide the contractor with a completely planned vibrating unit for the production of precast concrete on the site. Our technical advice service will be pleased to suggest a comprehensive plan, using both fixed tables and mobile 'Vibra-Lifta' tables, which will show the economy and efficiency to be obtained from using a Triton vibrating system on the site.



FIXED

Two Triton tables, each 4' x 4' vibrating a 15' purlin. These tables can be mounted on concrete blocks of any required height.

MOBILE

Two Triton mobile 'Vibra-Lifta' tables, vibrating a 25' beam. These 'Vibra-Lifta' tables can be moved at will over the site.

THE TRITON ENGINEERING CO (SALES) LTD

KINGSNORTH INDUSTRIAL ESTATE, WOTTON ROAD, ASHFORD, KENT

Telephone: Ashford 2851-2-3 Telegrams: Triton Ashford Kent

GLASS FIBRE and the FORMWORK DESIGNER

There is almost an unlimited scope in the design of formwork if glass fibre is used. Our wide experience in the use of this material in concrete work—which is second to none—is always available on all formwork problems

consult

D. A. MODELS LTD

108 WOODSTOCK ROAD, LONDON, W.4

Telephone: CHIswick 2011

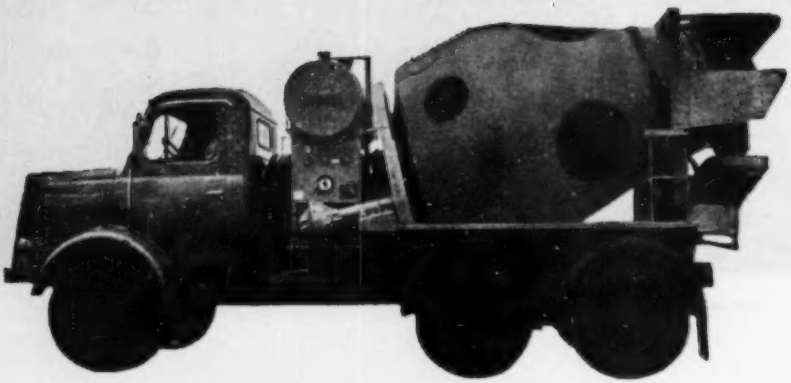
Workshop at Beckton Gasworks

40 years have passed since this industrial building was erected by Peter Lind and Company Limited. This recent photograph is proof of the lasting quality of good design and workmanship and supports our pledge of service to Clients

PETER LIND

Peter Lind and Company Limited Romney House Tufton Street London SW1

TRUCK MIXERS



Available in several capacities, either with petrol or Diesel engine or power take-off.
Quick and intensive mixing.
Quick charging and discharging.

DE JONG

HAZERSWOUDE HOLLAND
P.O. Box 88 LEIDEN
Over 40 years' experience in the construction of contractors machinery.

PZ

the modern method of

PRESTRESSED CONCRETE DESIGN AND CONSTRUCTION

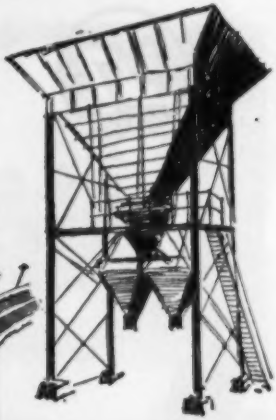
FOR INSITU AND PRECAST STRUCTURES OF ALL TYPES

This system is described and illustrated in our Catalogue, together with some of the many important contracts on which it has been used. Engineers and Contractors interested in the latest developments should send for a copy.

THE PZ PRESTRESSING CO. LTD.

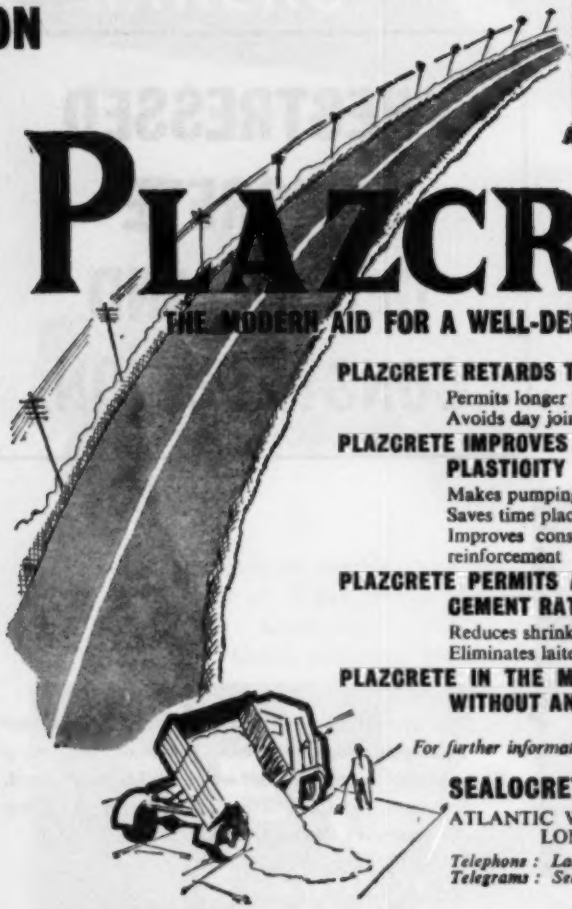
BURCOTT LODGE, BURCOTT, WING, LEIGHTON BUZZARD. *TELEPHONE:* WING 286

FOR THE LONG HAUL RELY ON



PLAZCRETE

THE MODERN AID FOR A WELL-DESIGNED CEMENT MIX



PLAZCRETE RETARDS THE SET

Permits longer haulage time
Avoids day joint problems

PLAZCRETE IMPROVES WORKABILITY AND PLASTICITY

Makes pumping easier
Saves time placing and vibrating
Improves consolidation, particularly around reinforcement

PLAZCRETE PERMITS A REDUCED WATER/CEMENT RATIO

Reduces shrinkage
Eliminates laitence, bleeding and segregation

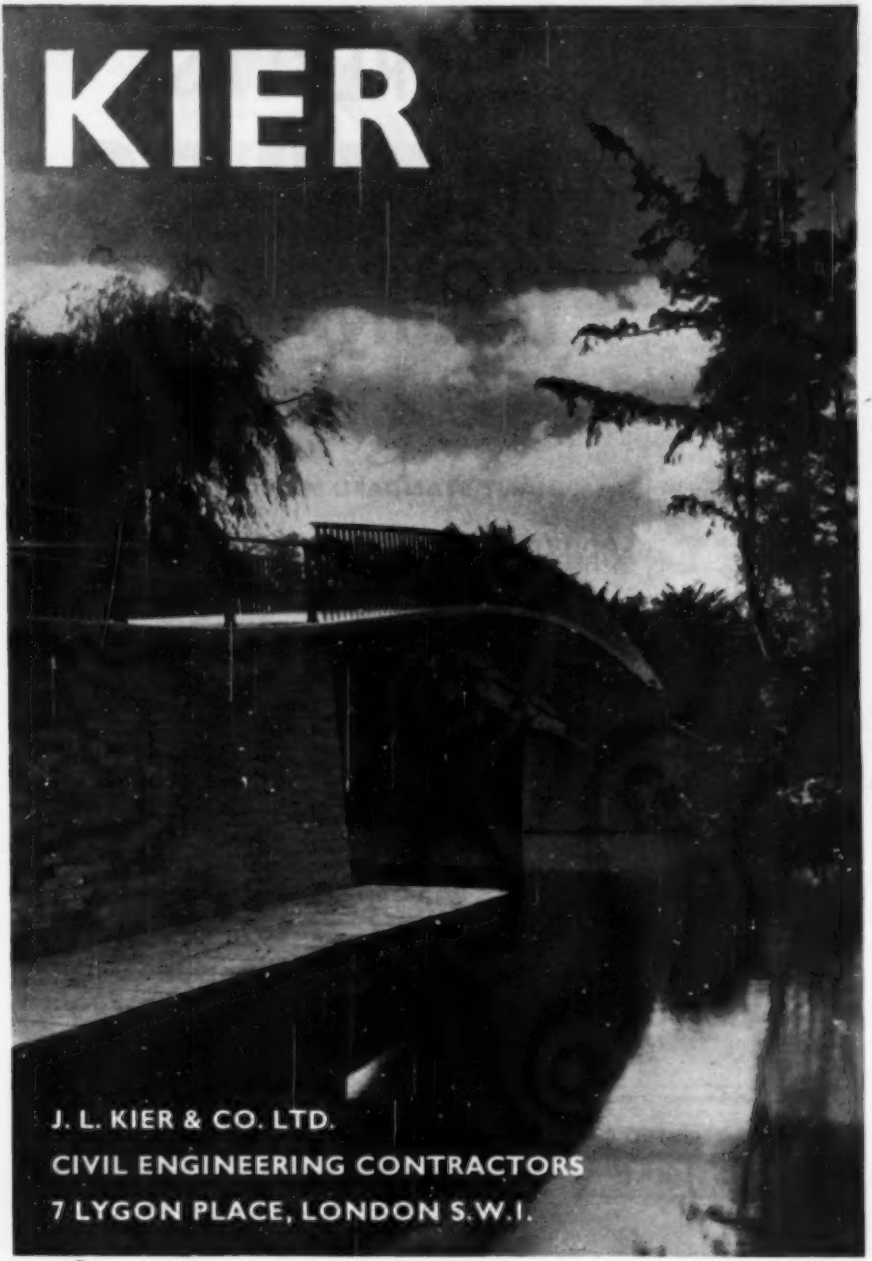
PLAZCRETE IN THE MIX REDUCES THE COST WITHOUT ANY LOSS OF STRENGTH

For further information write to Dept. PC.:

SEALOCRETE PRODUCTS LTD.,
ATLANTIC WORKS, HYTHE ROAD,
LONDON, N.W.10.

Telephone: Ladbroke 0015, P.B.E.
Telegrams: Sealocrete, Wesphone, London.

N.B. When retarding of the set is not required Plazcrete (Non-retarding) can be supplied.


KIER
J. L. KIER & CO. LTD.
CIVIL ENGINEERING CONTRACTORS
7 LYGON PLACE, LONDON S.W.1.

B

CRF

FIBREGLASS MOULDS to any design

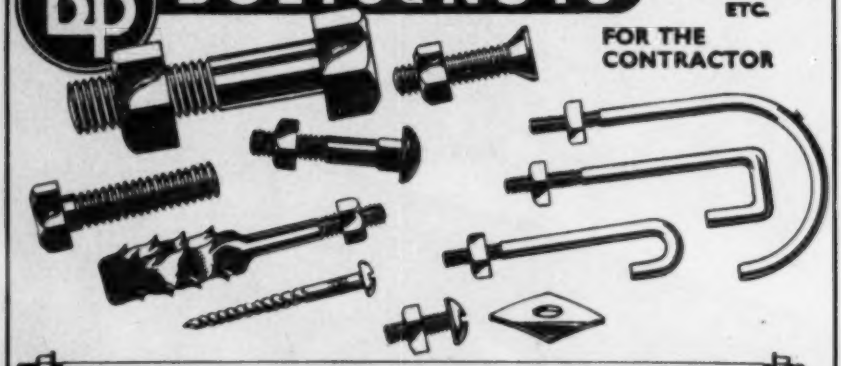
The following advantages of fibreglass moulds will save you time and money—RAPID MOULD RELEASE (a fibreglass mould can be supplied in one piece for most designs) · FAR SUPERIOR FINISH · EXTREME FREEDOM IN DESIGN AND SIZE · WONDERFUL HANDLING LIGHTNESS · MUCH QUICKER PRODUCTION · STEEL-LIKE TOUGHNESS · INCREASED MOULD LIFE

The CRF Fibreglass Mould Service can cater for all your mould requirements—whatever the design and size—and will give immediate attention to all inquiries. A Technical Representative is always available at any time to discuss mould problems with you.

MANY STANDARD MOULDS IN STOCK

CROYDON REINFORCED FIBREGLASS CO.
288 LONDON ROAD, CROYDON, SURREY. TEL: CROYDON 4699

BD BOLTS & NUTS TIE-RODS ETC. FOR THE CONTRACTOR



Manufactured by
B. PRIEST & SONS LTD · OLD HILL · STAFFS · ENG.
Telephone: Cradley Heath 66501 (8 lines)

for

COROBAR

REGD TRADE MARK

COLD WORKED HIGH TENSILE REINFORCEMENT

MILD STEEL & HIGH TENSILE WELDED FABRIC

AN EFFICIENT SERVICE ASSURED
IN SUPPLY, BENDING & FIXING

THE ENGINEERING DESIGN & CONSTRUCTION COMPANY LIMITED

REINFORCEMENT SPECIALISTS

OFFICES: ARDSHIEL HOUSE EMPIRE WAY WEMBLEY MIDDX.

TELEPHONE: WEMBLEY 9474 TELEGRAMS: EDCON WEMBLEY

AB MOULDS

CAN BE RELIED UPON TO GIVE CONSISTENT SERVICE OVER MANY YEARS

The above illustration of a standard garden edging mould shows the tough construction of our moulds, which reduces expenditure on maintenance and constant replacement of moulds of less robust design.

A. B. MOULD & CONSTRUCTION CO., LTD.

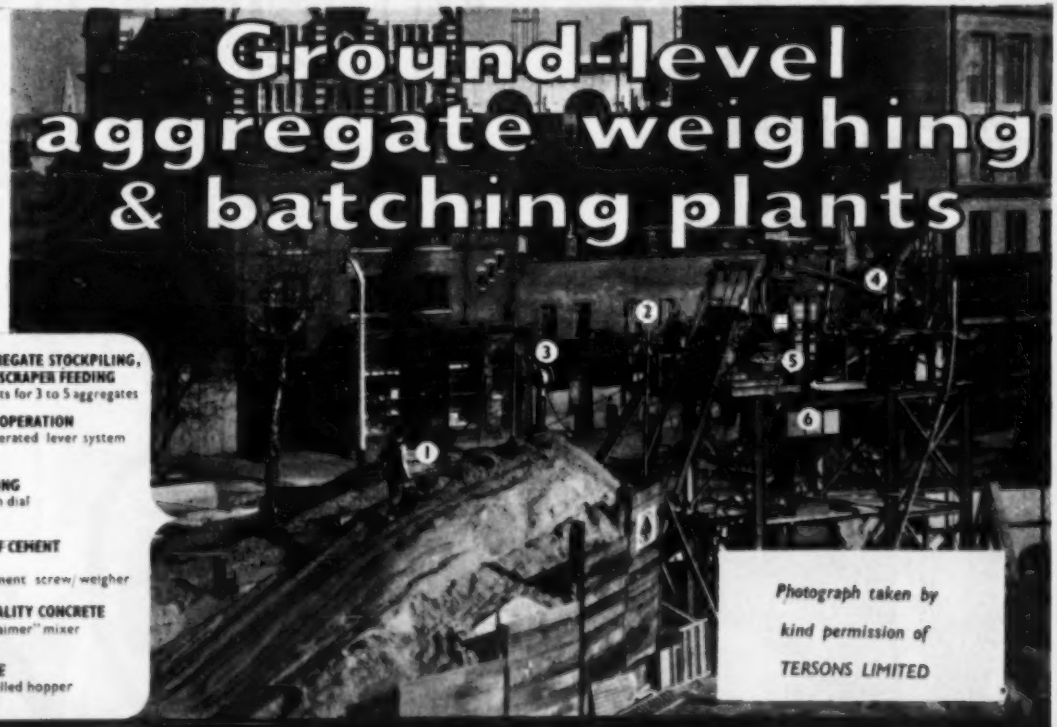
VULCAN WORKS, VULCAN WAY
NEW ADDINGTON, SURREY

Telephone : Lodge Hill 2347 *Telegrams : Abmould, Croydon*

TODAY'S MOST ACCURATE, SPEEDY AND ECONOMICAL SYSTEM OF CONCRETE PREPARATION

ACE
"ELBA"

Ground-level aggregate weighing & batching plants



1. **"ON THE JOB" AGGREGATE STOCKPILING, CONTINUOUS HANDSCRAPER FEEDING**
... star compartments for 3 to 5 aggregates
2. **REMOTE CONTROL OPERATION**
... 'one man' operated lever system
3. **ACCURATE WEIGHING**
...clear view weigh dial
4. **DIRECT FEEDING OF CEMENT INTO MIXER PAN**
... high-angle cement screw/weigher
5. **HIGH-OUTPUT, QUALITY CONCRETE**
../rota-forced "Waimer" mixer
6. **CONCRETE STORAGE**
...remotely controlled hopper

Photograph taken by kind permission of TERSONS LIMITED

A.C.E. MACHINERY LIMITED · PORDEN ROAD · BRIXTON · LONDON · S.W.2
Telephone: BRIXTON 3293 (9 lines) Telegrams: Auscon Telex 23579 LONDON

42" diameter to 27" diameter straight back mould for manhole tapers.

Moulds and formwork

for the concrete industry

A service to the industry ranging from the small equipment illustrated to complete spinning plants, backed by years of technical experience.

We are now operating from our extensive new premises at the address below.

Further details and quotations sent on request

Coneybeare

THE ORIGINAL PIPE MOULDS

Coneybeare & Co. Ltd., Torrington Road, Ashford, Kent. *Tel:* Ashford 1545/6

Model VP 350-A (Swivel Base or Barrow Mounting)

Prompt Delivery. Highly Competitive Prices. Genuine Service. Re-Sale Terms Available.

For Greater Strength, Firmer Bonding and Better Surfacing of Concrete—

"BAXTUL"

Regd. Trade Mark *British Made*

Extra-High Frequency

INTERNAL CONCRETE VIBRATORS

- The model illustrated here operates at 9,000 to 15,000 Vibrations per minute from low flexible shaft speeds of 4,500 to 7,500 R.P.M.
- Petrol or Electric Drive.
- Robustly built throughout and backed by genuine service.
- Fitted centrifugal clutch, long-life flexible drive and Vibrator.

This unique machine, with quick-change additional tools, can also be used for: SURFACING, WET-RUBBING CONCRETE, GRINDING, DISC SANDING, AND DRILLING (up to 1¼" in Concrete, 1" in Steel, and 2" in Wood).

★ *We operate a 48-hour Shaft Repair Service for all makes. Write to-day for 8-page fully descriptive Catalogue.* Agents throughout the world.

30 years' experience in the design and manufacture of flex-shaft tools.

THE FLEXIBLE DRIVE & TOOL CO., LTD.

EDENBRIDGE, KENT. *Telephone:* 3385-6

LONDON OFFICE: 17 QUEENSBERRY WAY, S.W.7. *Telephone:* KENsington 3583

A BUILDER'S BEST FRIEND IS A FORD ENGINE

Equipment powered by a Ford Industrial engine starts with two major advantages — the heart of it is a tough, hard-working, reliable power-unit built to the most modern designs, and behind it is the famous Ford Service Organisation — a world-wide chain of factory-trained engineers with stocks of genuine Ford parts.

Cranes, Excavators, Dumpers, Loaders, Compressors, Generators, Pumps — all are available with Ford power-units, petrol or diesel.

Please send the coupon below for details of the Ford-powered equipment you are interested in.

FORD

SPELLS POWER

Please send me details of Ford-powered equipment of the following types

Type or class of equipment .....

YOUR FIRM'S NAME .....

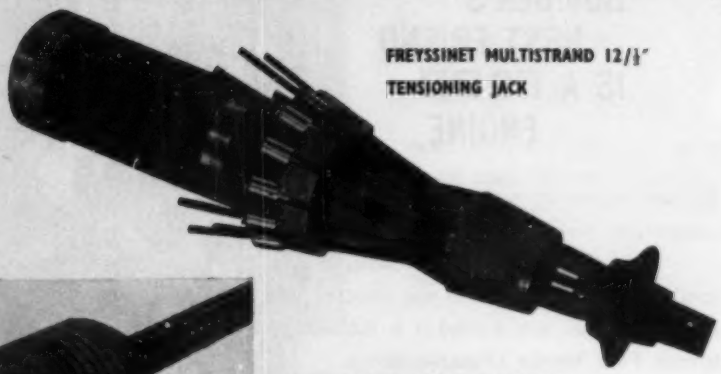
For the attention of Mr. .....

ADDRESS .....

.....

TO FORD INDUSTRIAL ENGINE DIVISION · DEPT G5b/CM6 · SOUTH OCKENDON · ROMFORD · ESSEX · ENGLAND

FREYSSINET PRESTRESSING

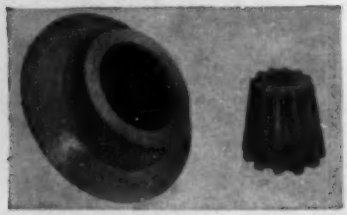


FREYSSINET MULTISTRAND 12/½"
TENSIONING JACK

FREYSSINET 12/276 ANCHORAGE

FREYSSINET PRESTRESSING

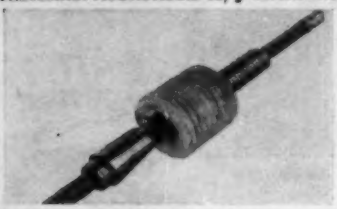
The Freyssinet system of prestressing provides a means of stressing and anchoring 12-wire cables simultaneously. Anchorages are available for the following sizes of cables: 12/200 (5 mm.), 12/276 (7 mm.), and 12/8 mm.



FREYSSINET MULTISTRAND 12/½" ANCHORAGE

FREYSSINET MULTISTRAND SYSTEM

The introduction of the MultiStrand system was a natural step in the development of Freyssinet prestressing techniques. The system is based upon the use of a cable of 12 No. 7-wire strands each of ½" diameter. The whole 12/½" cable is stressed in a single operation and provides an initial design force of approximately 140 tons.



FREYSSISTRAND 1½" ANCHORAGE

FREYSSISTRAND SYSTEM

The FreyssiStrand system was developed to facilitate the use of large diameter multi-layer strand. The system is designed for use with the following sizes of strand: ¾", 1" and 1½" diameter.

The range of prestressing service which the Freyssinet and P.S.C. Organisation can offer is as broad as the very problems to be resolved. These services are available to all concerned with the design, manufacture and construction of prestressed concrete structures.

PSC

PIONEERS OF PRESTRESSED

PSC PRESTRESSING

P.S.C. MONOWIRE
POST-TENSIONING JACK

P.S.C. MONOWIRE SYSTEM

This system of prestressing provides a greater variation of prestressing force than heavier systems and was produced for this particular reason. It is based on the tensioning of wires individually.

P.S.C. MONOWIRE 12/276 ANCHORAGE

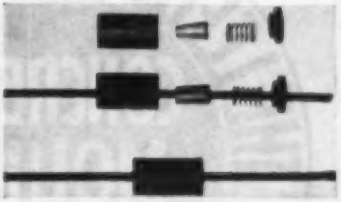
P.S.C. MONOSTRAND SYSTEM

This system has been developed to provide a variable range of prestressing forces by tensioning strands individually. Anchorages are available for the following sizes of strand: $\frac{1}{10}$", $\frac{3}{16}$", $\frac{7}{16}$" and $\frac{1}{2}$".

P.S.C. MONOSTRAND $\frac{1}{2}$" ANCHORAGE

P.S.C. PRETENSIONING SYSTEMS

P.S.C. pretensioning jacks are available for use with all sizes of wire up to 0·276 (7 mm.) or strand up to $\frac{1}{2}$" dia. A large range of anchorage sizes is available for use with both strand and wire.



P.S.C. SPRING-LOADED MULTI-USE ANCHORAGE

PSC

EQUIPMENT LTD

HEAD OFFICE AND WORKS: ARUNDEL ROAD, INDUSTRIAL TRADING ESTATE, UXBRIDGE, MIDDX
Telephone: Uxbridge 35241

CONCRETE IN GREAT BRITAIN

CONCRETE PROOFING CO. LTD.

GUNITE SPECIALISTS

Expert advice and schemes submitted for gunite work of every kind. Complete information on the various uses of gunite will be gladly sent on request

116 Richmond Road, Kingston-upon-Thames, Surrey. Telephone: KINGSTON 7883 and 9252

And 10 Royal Crescent, Glasgow, C.3. Telephone: GLASGOW DOUGLAS 8471

THE LEEDS OIL & GREASE CO. · CHADWICK ST, LEEDS ·

CONCRETE MOULD OIL

PUT YOUR FAITH IN THE TESTED BRAND

THIS LABEL ON EVERY BARREL CARRIES WITH IT FIFTY YEARS' EXPERIENCE OF MANUFACTURE.

NONE OTHER IS "JUST AS GOOD"

THE LEEDS OIL & GREASE CO.

Phone 22488 LEEDS, 10 'Grams: "Grease, Leeds 10"

FABRIC REINFORCEMENT by McCALLS

FABRIC · BARS · TENTOR · BENDING · MACALLOY · DESIGN

McCALL & CO (SHEFFIELD) LTD. McCALLS MACALLOY LIMITED

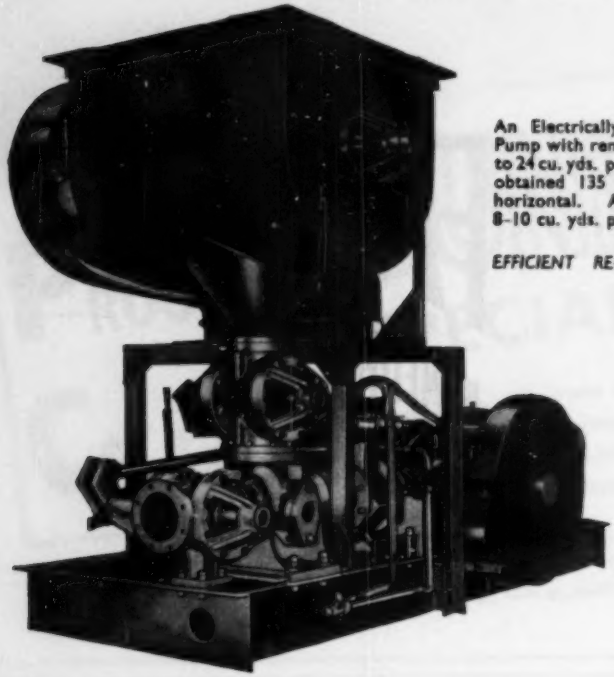
TEMPLEBOROUGH · SHEFFIELD · ENGLAND · P.O. BOX 41

Telephone: ROTHERHAM 2076 (P.B. Ex 8 lines)

LONDON: SLOANE 0428 *BIRMINGHAM:* ACOCKS GREEN 0229

PORTSMOUTH: COSHAM 78702 *MANCHESTER:* BLACKFRIARS 1018

SRB.17



An Electrically Driven PC3 Concrete Pump with remixer. Capacities from 20 to 24 cu. yds. per hour. Ranges actually obtained 135 ft. vertical or 1,500 ft. horizontal. Also smaller model PC4—8–10 cu. yds. per hour.

EFFICIENT RECONDITIONING SERVICE

CONCRETE BY PUMP AND PIPELINE

- The most efficient method of placing concrete.
- Life of Pump practically indefinite : all essential surfaces in contact with concrete are renewable.
- Pumpable concrete must of necessity be good concrete.
- Pump and Mixing Plant can be located at the most convenient position within the pumping range.
- The continuous output of the Pump at a constant speed governs the working of the whole concreting gang.

THE REGISTERED TRADE MARK OF **PUMPCRET** THE CONCRETE PUMP COMPANY LIMITED

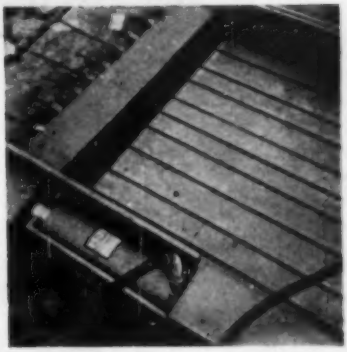
THE CONCRETE PUMP COMPANY LTD

4 STAFFORD TERRACE, LONDON, W.8

Telephone : Western 3546 **Telegrams : Pumpcret, Kens, London**

AT LAST—A PORTABLE STRESSING BED

AT A SENSIBLE PRICE



IT WILL MAKE—

- FLOOR BEAMS
- LINTELS
- PLANK UNITS
- FENCE POSTS
- RAFTERS
- PURLINS
- BEAMS

YOU CAN—

- MOVE IT
- VIBRATE IT
- STACK IT FOR CURING (STEAM OR NATURAL)
- USE IT IN FACTORY OR ON SITE
- USE IT FOR INSTRUCTION OR RESEARCH

PRICE:

COMPLETE BED LESS JACKING EQUIPMENT	**£225.0.0**
COMPLETE JACKING SET	**£126.0.0**

(WILL STRESS ANY NUMBER OF BEDS) Comprising: 2 Hydraulic Rams, 2 Pumps, 2 Pressure Gauges with Flexible Hoses and Quick-Couplers

Specification:

Construction—All Steel	
Capacity—50 tons Max.	
For use with—Wire or Strand	
Making Area	31 ft. × 3 ft.
Overall Size	33 ft. × 4 ft.
Weight	2,400 lb.

STRESSING DEVELOPMENTS LTD.

5 KINGSTON HILL, KINGSTON-UPON-THAMES *'PHONE: KINGSTON 2372 'GRAMS: STRESS, KINGSTON*

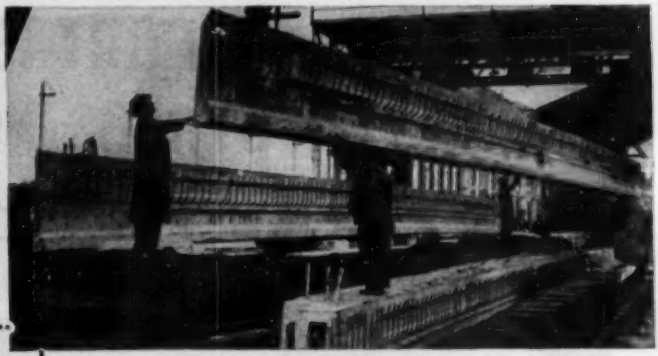


Illustration above shows some of the post-stressed bridge beams, each 80 ft. long and weighing 35 tons, produced by Anglian Building Products Ltd., for British Railways, Midland Region. Main Contractors: Messrs. Leonard Fairclough Ltd.

80-ft. BEAMS *cast in* WOODEN MOULDS *supplied by*

MAY & BUTCHER LTD

SPECIALISTS IN TIMBER SHUTTERS AND MOULDS FOR CONCRETE

More and more Contractors and Precast Concrete Makers in all parts of the country are taking advantage of the first-class service we offer in the supply of timber shutters and moulds to any design and size. This service has proved over and over again that by ordering your shutters and moulds from us you effect every possible saving in time, labour and money. However intricate the shutter or mould, you are assured of accuracy in every detail and a product with long trouble-free life. Shutters and moulds can be supplied with a plastic lining if desired. Full details of this class of work carried out by us are available on request.

HEYBRIDGE BASIN, MALDON, ESSEX. TELEPHONE: MALDON 698/9

Colcrete

GROUTED CONCRETE CONSTRUCTION . . .

Gammon India have used the Colcrete Process for construction of the Brahmani Pick-up Weir, near Rourkela, and, in partnership with Hochtief A.G. Essen, for much of the foundations in the steelworks being erected for Hindustan Steel Ltd. at Rourkela.

Gammon India have recently obtained a contract for the construction in Colcrete of the great Mundali Weir, which will cost some £1,500,000.

Colcrete is the product of the colloidal grouting process, invented by Mr. John C. Gammon with the late Mr. J. S. Morgan, whereby a grout of cement and sand is injected into stone.

COLCRETE LIMITED

STROOD · ROCHESTER · KENT

Phone Strood 78431/2/3. Grams : Groutcrete, Rochester

STORER'S

Sawing, Planing and Moulding Mills and Storage Yards at Barking

for

SOFTWOOD

Wm. T. STORER & CO. LTD.

Timber Importers and Merchants

ESTABLISHED 1913

Telephone: RIPpleway 0301 (10 lines)

RIVER ROAD - BARKING - ESSEX

INSEPARABLE from REINFORCEMENT

. . . OF COURSE!

and a guarantee that the specified concrete cover is accurately maintained . . .

Complying in ALL respects to the British Standard & Codes of Practice. The U-KLIPON BAR SPACER of revolutionary design is instantly fixed with a vice-like grip in the desired position on all types of reinforcement, including mesh and prefabricated. As an inseparable part it positively cannot be displaced by heavy tamping or vibrating. For any Bar Spacing problem,

CONSULT
THE B.E.C. BAR SPACER SERVICE

which has been and is responsible for the most outstanding and prominent contribution to accurate bar spacing in reinforced concrete, thus providing precision, economy, and labour-saving means of ensuring that the specified concrete " cover " is maintained under all conditions. It is noteworthy that such is the increasing popularity and demand for " B.E.C." Bar Spacers, borne out by sales in excess of 35 millions, that we are able to RETAIN OUR PRICE LIST OF 1945 WITHOUT MODIFICATION. Over 120 stock sizes of bar spacers enable us to give immediate attention to requirements. Write now for comprehensive details and samples. Our Technical Consultants will call on request.

Patent Nos. 597,505, 715,563, 789,018, 818,538.
Registered Nos. 870,560, 886,239. English and foreign patents pending.

B.E.C. BEARER BLOCK
FOR GROUND BEAMS · BARREL ROOFING BRIDGES · MAT WORK · ETC.

The " B.E.C." precision-made bearer block is another inexpensive B.E.C. aid to obtain accuracy with speed in concrete construction. Let us send you full details.

Enhance your Prestige. Specify and use with confidence.

BERRY'S ENGINEERING CO.
SOLE MANUFACTURERS:
Middle Road, Shoreham-by-Sea, Sussex
Phone and Grams: Shoreham-by-Sea 3541-2
CONTRACTORS TO MINISTRY OF SUPPLY, ETC., ETC.

C

May we

PRECAST

your

STRUCTURAL COLUMNS

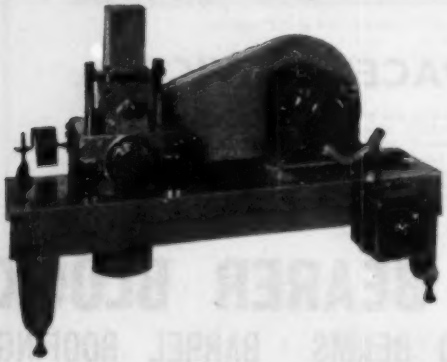
and

SAVE TIME SAVE MONEY

J. A. KING & Co., Ltd

181 Queen Victoria St., LONDON, E.C.4

Telephone: CENtral 5866 (5 lines) Telegrams: Kinovique Cent London



For compacting mortar cubes for compression tests to

B.S. 12/1958, 146, 1370, 915

Automatic Time Control

"CAPCO"

H.F. VIBRATOR

"CAPCO" CONCRETE TESTING APPARATUS also includes: Cube Moulds; Slump Cones; Tensile, Vicat and Cylindrical Moulds; Compacting Factor Apparatus—Standard and Automatic; Sieve Vibrators and Sieves; etc.

CAPLIN ENGINEERING CO. LTD

(ESTABLISHED 1918)

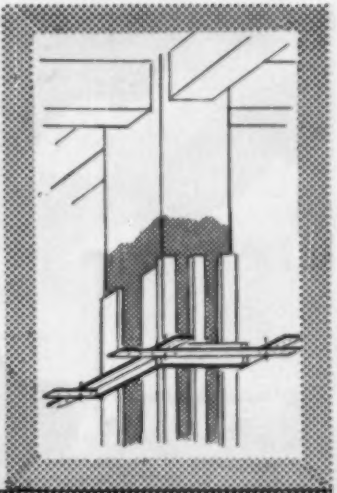
POLLEN HOUSE, 10/12 CORK STREET, LONDON, W.1

Phone: REGENT 0716. Grams: CAPLINKO, LONDON. Telex: 23255. Cables: CAPLINKO, LONDON. Works: IPSWICH.

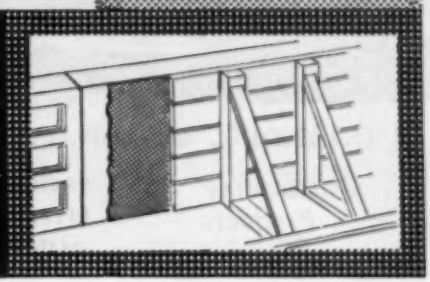
A Finer Finish at Lower Cost

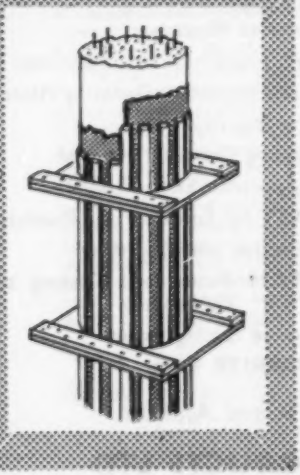
MASONITE SHUTTERING

forms Better Concrete



Large sheets of
SWEDISH MADE
MASONITE
tempered presdwood
SIZES $\frac{1}{8}$ — $\frac{5}{16}$ — $\frac{1}{4}$ — $\frac{5}{16}$

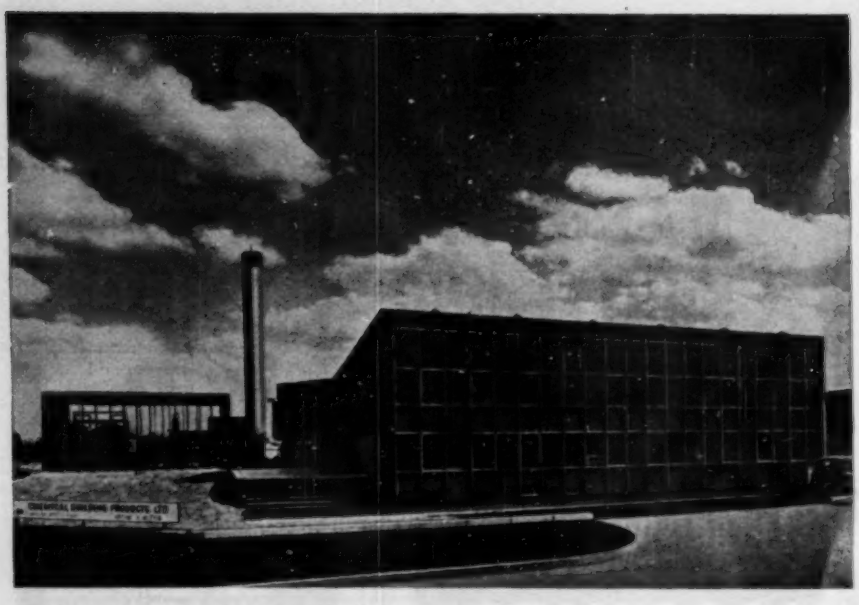




For continuous and repetitive use, where reliability and speed are essential, Masonite $\frac{1}{4}$" and $\frac{5}{16}$" Tempered Presdwood is the ideal form liner made especially for concrete work available in sheets 4′ × 9′ and 8′.

For curved shuttering down to a 9" radius, specify Masonite $\frac{1}{8}$" Tempered Presdwood, the 'companion' shutter board that gives a smooth form finished concrete and lightens shuttering assembly work.

MASONITE LIMITED
BEVIS MARKS HOUSE, BEVIS MARKS,
LONDON, E.C.3
Tel: AVEnue 3846 Grams: Etnosam, Fen, London



OUTSTANDING BUILDING . . .

Outstanding Products

CHEMICAL BUILDING PRODUCTS LTD
Warple Works
Cleveland Road
Hemel Hempstead
Herts

Telephone:
BOXMOOR 4900
(5 lines)
Telegrams: Prolithu
Hemel Hempstead

PROLAPIN Liquid Cement Waterproofer
LITHURIN Concrete Floor Hardener
QUICKSOCRETE P. Q. & D. Rapid Hardeners and Setters
WETEXI 'S' Colourless Silicone Waterproofer
CONPLAST Concrete Plasticiser
CONPLAST 'W' Anti-freeze and Plasticiser
CONBEX Plasticised Expanding Grouting Material
CEBEX 112 Mortar Improver
CEBEX 113 Expanding Grouting Material
CEBEX 124 Multi-purpose Slurry Liquid
ROAD CONPLAST Air Entrainer and Plasticiser
LIFTOYL Floor Cleaner and Degreaser
ORKIT & TEKTAM Bituminous Coating and Compounds
CONCURE Concrete Curing Agent
NITOLUX & ROBRITE Paints

NEW!! **SCREEDEX** *the Ideal Screed Additive.*

CHEMICAL BUILDING PRODUCTS LTD

18 storeys — 18 months!
Architect: Michael Rosenauer, F.R.I.B.A.
Main Contractors:
Sir Robert McAlpine & Sons Ltd.

TALLEST LONDON HOTEL USED NEW MULTISTRAND CABLE STRESSING

The first use of multistrand cables stressed in one operation in this country was in the building of the Carlton Tower Hotel.

The method created a great deal of interest: much more is likely to be heard of it in the future.

Prestressing was only economical over the main banqueting rooms, where beams span 53 feet. These beams support loads of 110 tons each, and were post-stressed by a special jack designed for stressing cables of $12 \times \frac{1}{2}$ in diameter strands, with an ultimate strength of over 200 tons per cable. The prestressing strand for this important project was supplied by Richard Johnson & Nephew.

wire was essential—

Johnsons

of course!

Richard Johnson & Nephew Limited, Manchester 11. Telephone EASt 1431

WE ARE SPECIALISTS ★ IN THE REPAIR ★ AND RECONDITIONING ★ OF REINFORCED ★ CONCRETE STRUCTURES ★

★ WATERTIGHT LININGS FOR RESERVOIRS SWIMMING POOLS, ETC.

★ LININGS FOR TUNNELS SEWERS

★ TANKS, ETC.

GUNITE CONSTRUCTION CO LTD

WESTERN HOUSE, HITCHIN, HERTS.

TELEGRAMS: 'GUNITE, HITCHIN'

TELEPHONE: HITCHIN 4371

COPPER STRIPS

for expansion joints

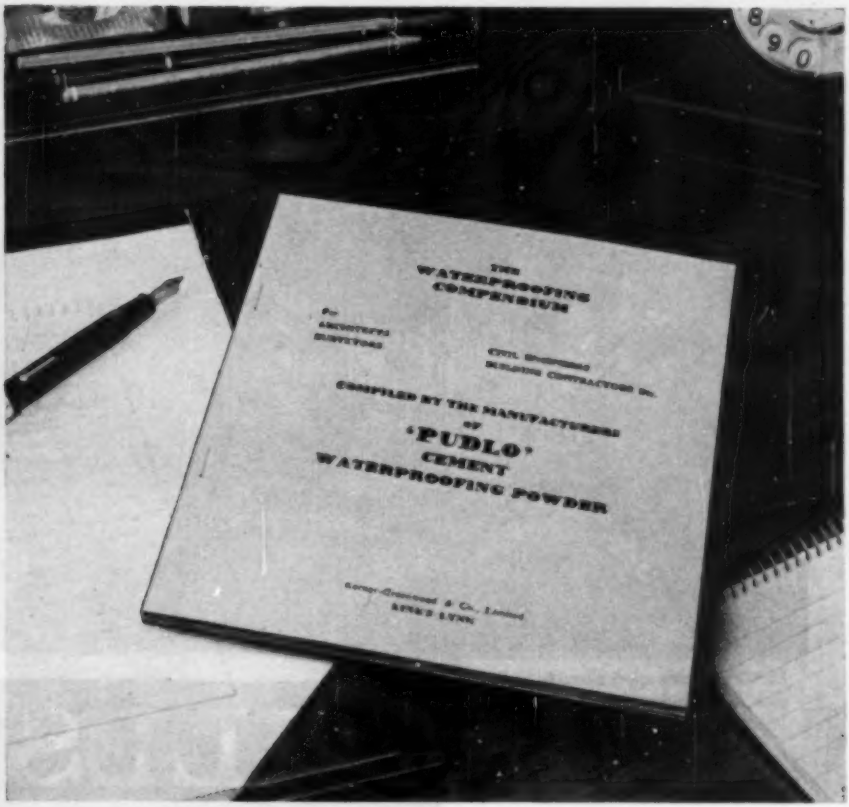
All Reinforced Concrete Engineers recognise the advantages of using copper strips for sealing joints in concrete work. Copper is ductile, will not crack under repeated bending, is non-corrosive and is unaffected by wet concrete. We specialise in the supply of perforated copper strips of all required lengths and widths for expansion joints, and shall be pleased to submit prices against detailed specification.

ALEX J. CHEETHAM LTD.

NORTON STREET • FAILSWORTH • MANCHESTER

Telephone: FAILsworth 1115/6

D8.14



Send now for YOUR free copy

We have just compiled an entirely new and up-to-date WATERPROOFING COMPENDIUM containing a wealth of information gathered during more than fifty years' experience in waterproofing throughout the world. Thumb-indexed for easy reference, the Compendium deals with, for instance, the waterproofing of new and existing underground structures, pools, ponds, tanks, etc., internal dampness, efflorescence, and many other items besides.

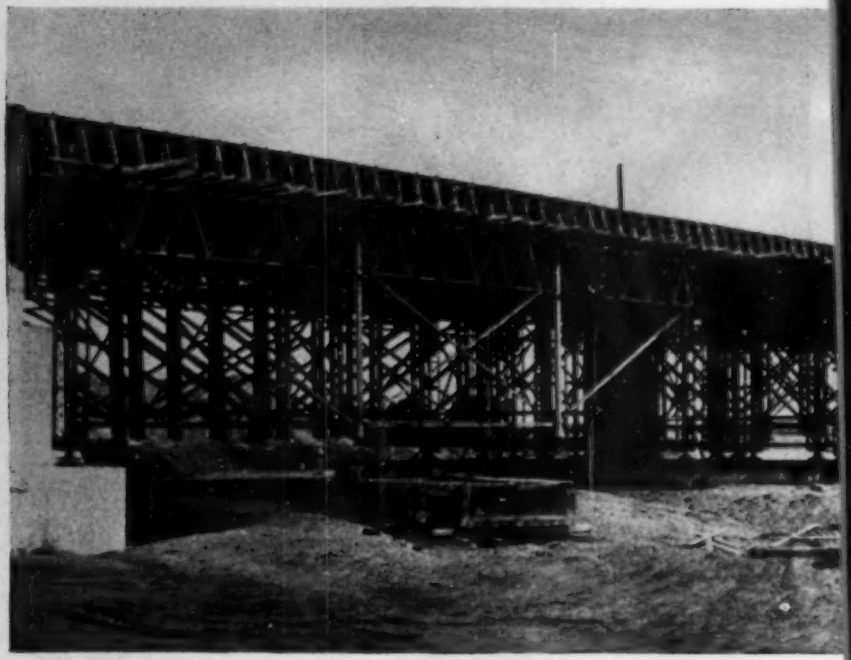
Send now for your free copy—a valuable addition to your bookshelf

'PUDLO'

Sole manufacturers of 'Pudlo' products:

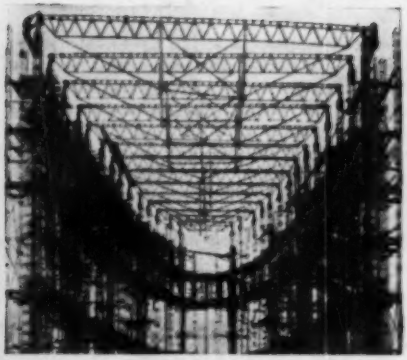
KERNER-GREENWOOD & CO LTD

KING'S LYNN, NORFOLK Telephone: 2293

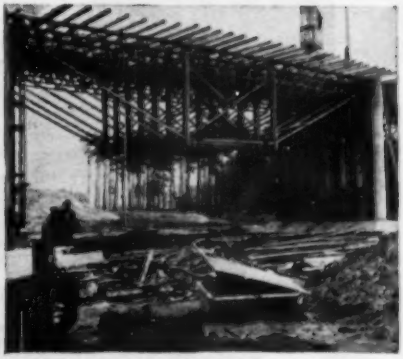


V800's spanning approximately 52 feet, with double under trussing.

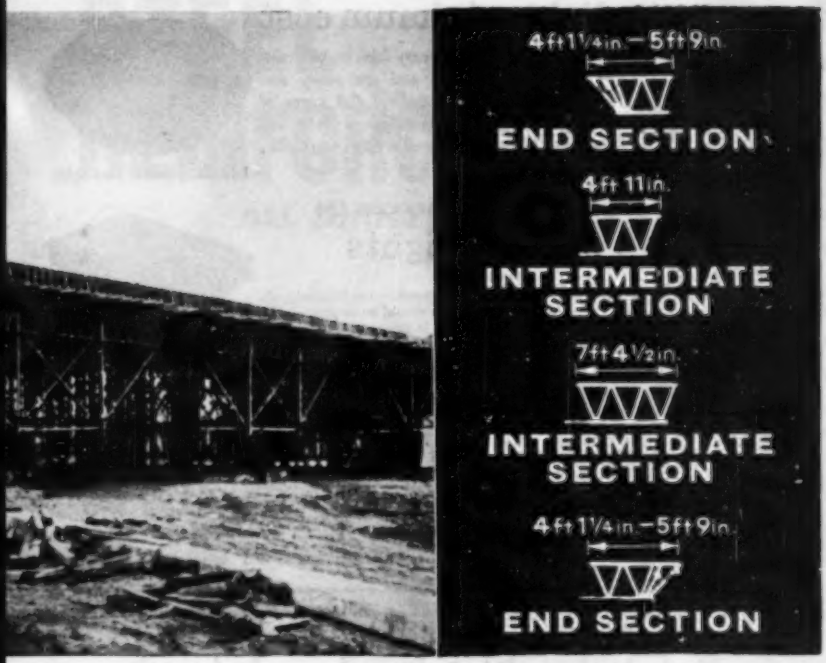
MILLS



This photograph illustrates the fine adjustment of spans which can be obtained with the V800.



V800's with double under trussing, spanning about 56 feet.



V800

ADJUSTABLE TRUSS

or heavy duty support to formwork

The Mills V800 Adjustable Truss is the ideal way of providing heavy duty support to formwork over long clear spans. It is assembled, basically, from end sections, adjustable from 4′ 1¼″ to 5′ 9″ and intermediate sections in lengths of 4′ 11″ and 7′ 4½″. The carrying capacity of the beam can be considerably increased by employing under-tensioning members as a truss. The swivel connections make it possible, by the adjustment of turnbuckles in the lower chord, to use the beam either straight, cranked or arched. Mills V800 Adjustable Truss is available for sale or hire.

PLANNING SERVICE

A planning service is available for users of the V800 Adjustable Truss, providing drawings for specific requirements and erection supervision on major contracts.

MILLS SCAFFOLD CO. LTD.

Trussley Works, Hammersmith Grove, London W.6. (RIVerside 3011)

A MEMBER OF THE GKN GROUP OF COMPANIES

Depots: BIRMINGHAM · BOURNEMOUTH · BRADFORD BRIGHTON · BRISTOL · CANTERBURY · CARDIFF · COVENTRY CROYDON · DUNDEE · EDINBURGH · GLASGOW · HASTINGS HULL · ILFORD · LEICESTER · LIVERPOOL · LONDON MANCHESTER · MIDDLESBROUGH · NEWCASTLE · NOTTINGHAM OXFORD · PRESTON · PLYMOUTH · PORTSMOUTH READING · ROTHERHAM · SOUTHAMPTON · SWANSEA

LENSCRETE LTD

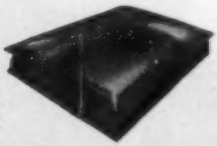
maximum light minimum cost

LITEX roof lights give a very high transmission of light—up to 92%—and are easily and quickly handled and fitted. A full range of standard form metal ventilators, curbs and liners are available for use with LITEX roof lights.

LITEX spherical roof lights

Litex LAMINATED FIBREGLASS roof lights

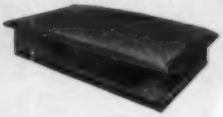
LITEX roof lights with their glass fibre reinforced construction can be used with advantage in many places where conventional lights would be impracticable or too costly. Virtually unbreakable, heavy packing is unnecessary allowing quick and easy handling on site.



LITEX rectangular roof lights

LITEX roof lights are ideal for use in schools, hospitals and other buildings where absolute safety is required—they will not shatter and cannot support combustion. The plastic will not creep, nor become brittle with age or very hot temperatures.

LITEX roof lights are not attacked by smoke or fumes from most industrial processes, and may safely be used in factory and workshop buildings.



LITEX lantern lights

For further information about LITEX roof lights please write to

LENSCRETE LIMITED Queens Circus London SW8 telephone MACaulay 1063

GUNITE SPECIALISTS

WM. MULCASTER & CO. (CONTRACTORS) LTD.

We invite inquiries for Gunite Linings and Renderings for new or old structures of every kind in any part of the country.

HASLINGTON CREWE

Telephone : Crewe 2265-6

STEEL REINFORCEMENT

ALL DIAMETERS

A COMPLETE REINFORCEMENT SERVICE

DESIGN · SUPPLY · CUT
BEND · LABEL
DELIVER & FIX

Let us have your specification for all or any part of these services & we will quote you our competitive prices delivered works or site.

Write, telephone or telex your requirements

WELBECK

(STEEL STOCKHOLDERS) LTD

STEEL WHARF, RIVER ROAD,
BARKING, ESSEX

Telephone: RIPpleway 5751-4
Telegraphic add.: Steelwarf, Barking, Telex.
Telex: 21194

Throughout the U.K. the Blue Circle Group of Companies has 29 cement works and 30 manufacturing plants at which are produced Blue Circle, Pelican and Dragon brands of Portland Cement, Ferrocrete, '417' Cement, Aquacrete, Sulfacrete, Hydracrete, Walcrete, Snowcrete, Colorcrete, Hydralime, Whiting, Super Snowcem, etc. It has 16 district offices and a network of distribution centres. The road transport owned by the Group includes over 1,200 vehicles for delivery in bag or in bulk, and it operates one of the largest fleets of tugs and lighters on the Thames and Medway.

The Blue Circle Group is the largest cement manufacturing organisation in the world. You are invited to make use of its many services and profit from its great resources.

Blue Circle Products are exported to countries all over the world and the Group also has interests in twelve works overseas, nine of which are in the Commonwealth.

A BLUE CIRCLE PRODUCT

The Cement Marketing Company Limited,
Portland House, Tothill Street, London, S.W.1. Telephone TATe Gallery 3456
G. & T. Earle Limited, Hull. Telephone Hull 26121
The South Wales Portland Cement & Lime Co. Ltd., Penarth, Glam.
Telephone Penarth 57301-4

TO CURE OR TO SAVE?

There's a world of difference between curing your bacon and saving it—but those unversed in the vagaries of the English language might be understandably confused.

With concrete there's no such confusion. Correct curing is essential to successful concreting—and the SBD "RITECURE" method saves endless time and trouble.

At Stuart B. Dickens, curing is just one aspect of the work we do in advanced concrete technology. Our product RITECURE, the membrane method of curing, has given concrete evidence of its effectiveness to the tune of over 35 million yards super in this country alone.

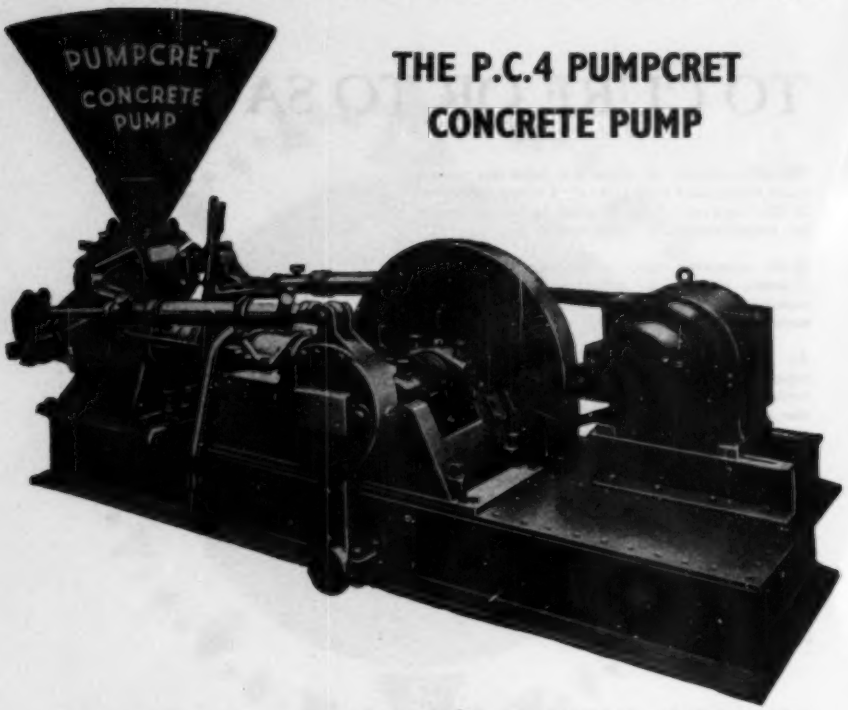
MOLDCOTE for formwork treatment, MULSIBOND for bonding, the STERNSON range of waterproofers and hardeners; all are products of years of research and known throughout the trade. Whatever or wherever your concern is with top-class concrete, there is no wiser first step than calling on the experience of

STUART B. DICKENS LTD

Manor Way, Boreham Wood, Hertfordshire

Telephone: ELStree 2211

SBD PRODUCTS



THE P.C.4 PUMPCRET CONCRETE PUMP

CONCRETE BY PUMP AND PIPELINE

Specifications:

Two Sizes	P.C.3	P.C.4
Capacities per hour, approx. . .	20–24 cu. yd.	8–10 cu. yd.
Range:		
Horizontal, approx.	1500 ft.	1250 ft.
or Vertical, approx.	135 ft.	125 ft.
Pipeline	6″ i.d.	4½″ i.d.
Power required: Electric or Diesel	45 h.p.	25 h.p.

FOR HIRE

PUMPCRET

THE REGISTERED TRADE MARK OF THE CONCRETE PUMP COMPANY LIMITED

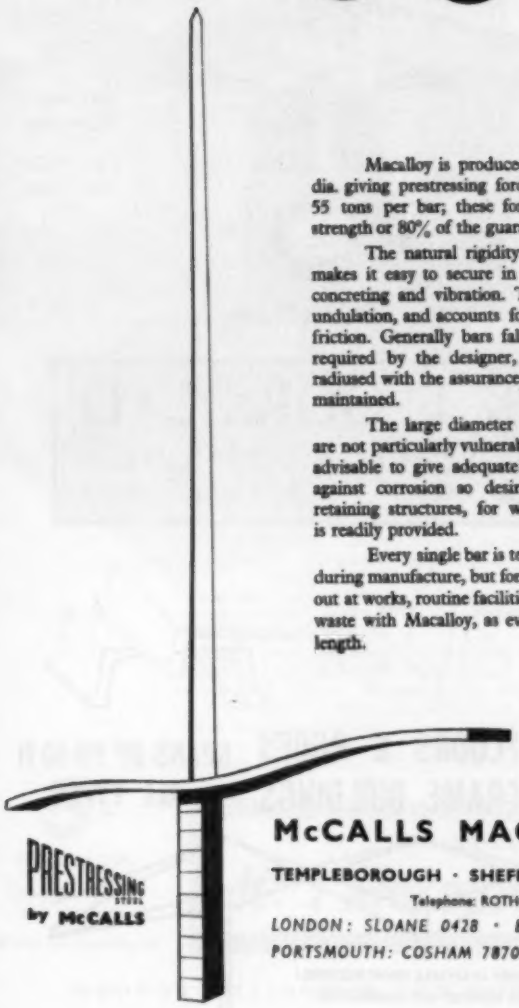
PUMPCRET HIRE COMPANY LTD

4 STAFFORD TERRACE, LONDON, W.8

Telephone: Western 3546. Telegrams: Pumpcret, Kens, London

THE MACALLOY BAR

27T 35T 45T 55T



Macalloy is produced in four sizes, ¾", 1", 1¼", and 1¾" dia. giving prestressing forces (before losses) of 27, 35, 45 and 55 tons per bar; these forces represent 70% of the ultimate strength or 80% of the guaranteed 0.2% proof stress.

The natural rigidity of the Macalloy bar in its sheath makes it easy to secure in the exact position intended during concreting and vibration. This rigidity ensures freedom from undulation, and accounts for the relatively small losses due to friction. Generally bars fall naturally into the shape of curve required by the designer, but in special cases they can be radiused with the assurance that the pre-formed radius will be maintained.

The large diameter bars used in Macalloy prestressing are not particularly vulnerable to corrosion, but it is nevertheless advisable to give adequate protection. The first class assurance against corrosion so desirable in bridge, marine and water retaining structures, for which Macalloy is especially suited, is readily provided.

Every single bar is tested to well beyond its rated capacity during manufacture, but for anyone who wants inspection carried out at works, routine facilities exist for the inspector. There is no waste with Macalloy, as every bar is supplied cut to the right length.

PRESTRESSING STEEL by McCALLS

McCALLS MACALLOY LIMITED

TEMPLEBOROUGH · SHEFFIELD · ENGLAND · P.O. BOX 41

Telephone: ROTHERHAM 2076 (P.B.X. 8 lines)

LONDON: SLOANE 0428 · BIRMINGHAM: ACOCKS GREEN 0229

PORTSMOUTH: COSHAM 78702 · MANCHESTER: BLACKFRIARS 1018

PC67

Testing concrete cubes on site

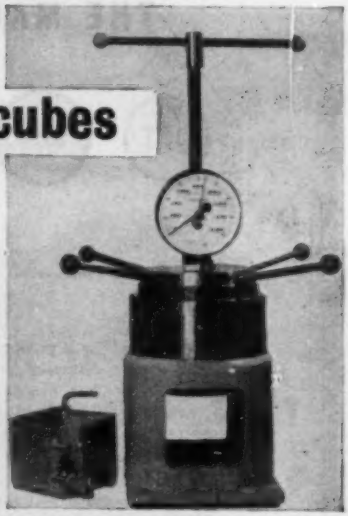
MILBANK-WELLS

HYDRAULIC PRESS AND CUBE MOULDS

Immediate Delivery

Two Sizes: 4 in. and 6 in.

PRESSES and CUBE MOULDS
Testing to 16,000 lb. per sq. in. to B.S. 1881.



Approved for all Government Contracts

IN USE ALL OVER THE WORLD

6-IN. PRESS 258 TONS

4-IN. PRESS 110 TONS

MILBANK FLOORS LTD

PRESTRESSED CONCRETE CONSTRUCTION

RIVER HOUSE, EARLS COLNE, ESSEX Telephone: Earls Colne 410

PRESTRESSED FLOORS & ROOFS FRAME BUILDINGS

SPANS UP TO 40 ft ALL TYPES

SINGLE SPAN · MULTI SPAN · CANTILEVER

LILLINGTON'S NO. 1 Metallic liquid smooths the way for ATCO mowers

The new ATCO Service Branch at Marsh Barton, Exeter, is one of a chain spanning the country where anything from a quick service job on site or a major workshop overhaul can be tackled.

To render the concrete floors hard, waterproof, dust-free and able to withstand exceptionally heavy wear and tear, Lillington's No. 1 Metallic Liquid was the natural choice.

For fifty years architects have specified No. 1 Metallic Liquid, as the scientifically prepared admixture that makes concrete completely waterproof and dustless, as well as accelerating the setting time. No. 1 Metallic Liquid is a necessity for waterproofing cement renderings to walls and basements, mass concrete retaining walls, foundations, flat roofs and tanks. You can rely on Lillington's No. 1 Metallic Liquid to give complete satisfaction because IT IS THE ONLY PROOFER SOLD UNDER GUARANTEE.

FROM **5/-** PER GALLON

Special terms for bulk contracts

Write for Booklet 56

LILLINGTON'S

No. 1 Metallic Liquid

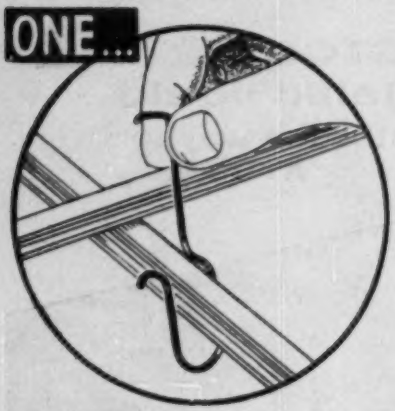
GEORGE LILLINGTON AND COMPANY LIMITED

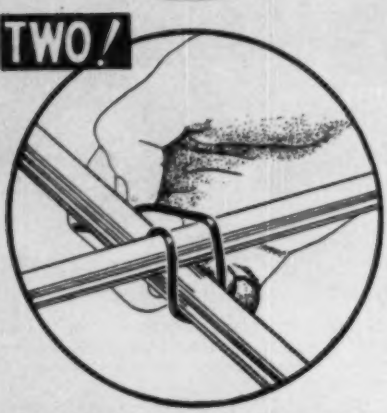
Willow Lane, Mitcham, Surrey. Tel: Mitcham 1066 For Scotland: 42 High Street, Greenock

ALL OUR PRODUCTS ARE SUPPLIED IN FREE CONTAINERS

AP 349

D





'STABIL' BINDERS

ARE GREAT LABOUR SAVERS

In one simple action they fix reinforcing rods as though welded. No slipping. No "fiddling" with wire. No tools to get mislaid. Any workman can use them. Made in all sizes for binding ¼-inch up to 1¼-inch rods. Give "Stabil" Binders a trial and judge for yourself.

● ***SEND TO-DAY for demonstration samples and prices.***

HUNTLEY & SPARKS LTD

JAMES ESTATE, WESTERN RD., MITCHAM, SURREY

Phone: MITcham 0121

Best Quality

CONCRETE AGGREGATES

in all grades

DELIVERED BY ROAD OR RAIL

WM. BOYER

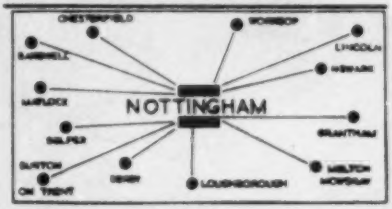
& SONS LTD

MEMBERS OF S. & G.A. of G.B.

ESTABLISHED 1810

IRONGATE WHARF, PADDINGTON, W.2

TELEPHONE : PADDINGTON 2024-6



Trent Gravels

10,000 tons per week

Washed & Crushed 1½ in. to ¼ in.

We are the leading suppliers of high-class concrete aggregates in the area shown above. Prompt deliveries guaranteed and keen competitive prices quoted. Send for samples and prices.

TRENT GRAVELS LTD

ATTENBOROUGH NOTTS

Telephone : Nottingham 25-4255

"CONCRETE SERIES"

BOOKS ON CONCRETE

For a complete catalogue giving prices in sterling and dollars, send a postcard to :

CONCRETE PUBLICATIONS, Ltd.

14 Dartmouth St., London, S.W.1

FOR CONCRETE PRODUCTS

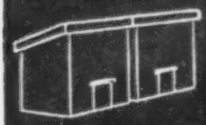
Invest in

RANALAH

STEEL

MOULDS

CUT CAPITAL COSTS
BETTER CASTS & MORE
CASTS PER MOULD



GARAGES, COAL BUNKERS, CILLS,
COPING STONES, AGRICULTURAL AND
INDUSTRIAL BUILDINGS, FENCING POSTS,
KERBS, GARDEN EDGING, ETC.

RANALAH STEEL MOULDS LTD

LOWER BEVENDEAN • BRIGHTON • SUSSEX TEL:62216-7-8

RECONSTRUCTED STONE REPLACES NATURAL STONE

STUARTS

GRANOLITHIC CO. LIMITED

ESTABLISHED 1840

Originators and still leading.

We also fix.

LONDON ADDRESS:
14 College Road, Harrow.
Tel: Harrow 6161-2-3

BIRMINGHAM:
Northcote Road, Stechford.
Stechford 3631-2

EXETER:
6-8 Melbourne Street. Exeter 73848

EDINBURGH:
46 Duff Street. Don 1351-2

MANCHESTER:
Ashton Rd., Bredbury, Stockport.
Woodley 2677-8

THIRD INTERNATIONAL
CONGRESS OF THE PRECAST CONCRETE INDUSTRY

Stockholm 1960

CONCRETE PUBLICATIONS LTD.

are distributing the Papers and Reports presented at this Congress on behalf of the

BRITISH CAST CONCRETE FEDERATION

All the papers and reports presented at this Congress are now available in the English language, in loose-leaf form in substantial binders. The publication is in two editions, one containing the reports and main papers only and the other the reports and main papers plus the reports and supplementary papers.

MAIN PAPERS AND REPORTS are grouped under the headings of Vibration; Shrinkage; Pipes; Precast Concrete for Buildings; Human Relations.

SUPPLEMENTARY PAPERS AND REPORTS on Thin-shell precast concrete; Precast bridge construction; Subways and short-span bridges; Precast flues; Concrete block industry; Test on beam with high strength reinforcement; Electrical curing.

Prices:

Main Papers and Reports.
£3. 3. 0. post free. In Canada and U.S.A. 15 dollars.
Main Papers and Reports with Supplementary Papers and Reports.
£4 4. 0. post free. In Canada and U.S.A. 20 dollars.

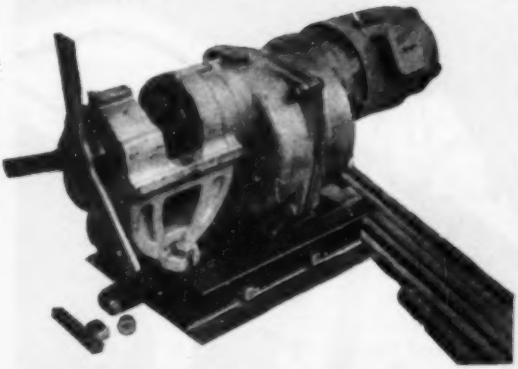
CONCRETE PUBLICATIONS LTD.
14 DARTMOUTH STREET, LONDON, S.W.1

ALL-BRITISH

ALLAM

HYDRAULIC BAR CROPPERS

FOR SALE OR HIRE



for

Reinforced Concrete

Contractors

The Standard Bar Cropper, illustrated on the left, has a capacity ranging from one 1¾-in. bar to eight ¾-in. diameter or smaller bars, including rounds, squares and flats.

for

Precast Concrete

Makers

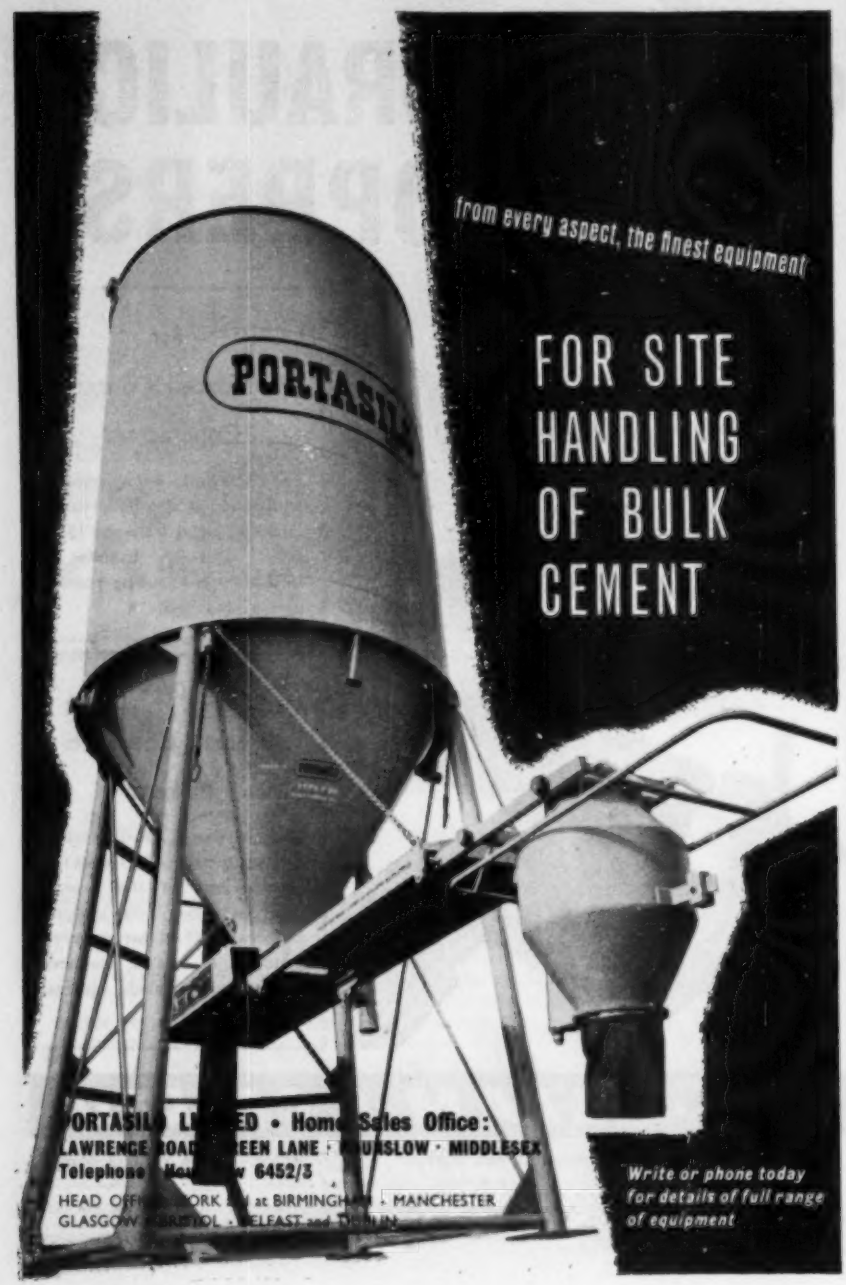
The small model, also illustrated, is specially designed to meet the requirements of the precast concrete maker. Its capacity includes one 1-in. bar down to multiples of smaller diameter bars, including rounds, squares, and flats.

E·P·ALLAM & CO. LTD.

LONDON: 132–135 Sloane Street, S.W.1. · Telephone: Sloane 9976 (5 lines)

Works: Southend-on-Sea Tel.: Eastwood 525243

AGENTS & DISTRIBUTORS: Strangford Ltd., Belfast and Dublin; A. Gunn & Co. Ltd., Altrincham, Ches.; O. L. Davies, Ltd., Port Talbot, Glam.; J. Lewis (Machinery) Ltd., Burslem, Stoke-on-Trent; Concrete Engineering Services, York Road Industrial Estate, Wetherby, Yorks; John Roulstone Ltd., Newcastle-on-Tyne; W. R. Selwood Ltd., Chandler's Ford, Southampton; J. A. McAra & Co. Ltd., Glasgow; Modern Plant Sales Ltd., Oldbury, Birmingham.


from every aspect, the finest equipment
FOR SITE HANDLING OF BULK CEMENT
PORTASILO
Write or phone today for details of full range of equipment

CONCRETE
AND
CONSTRUCTIONAL ENGINEERING
INCLUDING PRESTRESSED CONCRETE

Volume LVI, No. 8. LONDON, AUGUST, 1961.

EDITORIAL NOTES

"Concretor's Hands."

THE risk of contracting diseases of the skin, and in particular that of the hands, run by workers with cement, and many other materials, was brought to notice a few months ago by a lawsuit in which a past employee of a firm producing ready-mixed concrete sued unsuccessfully the firm for his having contracted dermatitis (sometimes called "concretor's hands" or "cementer's itch") because, he alleged, the firm did not supply him with protective means, namely barrier creams. The effectiveness of barrier creams was dealt with at some length in the course of the hearing. Although the theory that a barrier cream provides a layer which prevents noxious substances reaching the skin was maintained, it was not proved that such creams would be efficacious in the case cited, especially as the hands of the workman in question were soiled with oil and dirt as well as wet concrete.

Distinction is made between dermatitis caused by cement and that caused by oil, the latter cause being far more common. Especially virulent conditions exist when oil, dirt and cement (or a calcium compound such as lime) are in combination. Moisture, whether water or perspiration, aggravates the condition or increases the liability to attack. The exceptional virulence if moisture is present explains in part why cement dermatitis is likely to be more prevalent among workers with wet concrete or mortar than among men at cement works and elsewhere where the cement may be in the form of a dry dust. In the latter conditions, excessive sweating and over-dryness of the skin are predisposing factors. The cement dust settles on the sweating skin and becomes mixed in solution, resulting in generation of heat and an increase in alkalinity consequent upon slaking of the lime.

A summary of the present state of medical knowledge of the disease as experienced in the cement industry is given by Dr. Charles D. Calnan in an article entitled "Cement Dermatitis" in the "Journal of Occupational Medicine", January, 1960. Many investigators conclude that allergic eczematous hypersensitivity to chromate is the principal cause of dermatitis, although less extreme opinion states that chromate sensitivity may initiate and maintain cement dermatitis without being entirely the primary cause.

Medical opinion seems to concur that cement dermatitis is non-contagious and is only likely to occur if a workman is allergic to this particular form of cutaneous disease.

Chrome can be present in cement from various sources, the chief of which are the wearing down of balls of chromium steel in the grinding mills, and the abrasion of chrome-containing refractory bricks in the kiln. Some chrome may also be present in the pulverised coal used as fuel in the kilns. In an extreme case, the cause of the infection was attributed to a worker wearing chrome-tanned gloves when handling cement. The extent to which it is considered that some workmen are allergic to dermatitis is illustrated by the fact that one firm making precast concrete products required each new employee to certify that he had never suffered from the disease.

Conditions in the products industry may be such that workmen handle moulds which are at the same time oily and coated in part with wet concrete or cement grout, a condition which is very severe, especially to a workman who is in any way prone to dermatitis. Enquiries were made recently among several firms making products to determine the extent of the disease in this industry and what precautions were taken. It is encouraging to learn that cement dermatitis is not prevalent; most of the firms stress the importance of personal cleanliness, frequent washing, and a barrier cream applied to clean hands and arms. The effectiveness of barrier creams without previous cleanliness may be problematic but, as was pointed out in the course of the court case cited, the effectiveness in other conditions may yet be proved by the conducting of tests on a scientific basis. Assurance is given by the makers of barrier creams that research on this subject is progressing and that so far it seems evident that the value of such creams should not be under-rated. It is thought that the daily use of barrier creams, although not necessarily providing complete protection against dermatitis, certainly conditions the hands for easier and quicker removal of cement by washing and thereby no doubt helps to lessen the chances of dermatitis developing. It is also important that the skin should be free from cuts and abrasions, or that such injuries should be well covered, for example by wearing rubber gloves.

With continued development in all branches of the manufacturing and constructional industries, there is much hope that the incidence of dermatitis will be reduced even below the low level pertaining today. In the cement industry, where it is at the lowest prevailing level despite what might seem to be conditions conducive to the disease, it is likely to be reduced even more so by modern methods of packing, bulk transport, and dust control. In the constructional industry, automatic mixing and handling of concrete, often by remote control, removes much of the need for men to come in actual contact with wet concrete, although this contact when compacting by vibrators or otherwise does not yet seem to be avoidable. In the products industry, where oily moulds and wet concrete make conditions particularly virulent, some contact is also at present almost unavoidable but, as stated, there is evidence to show that personal cleanliness does much to mitigate, or even to prevent altogether, the onset of this unpleasant disease.

A Practical Comprehensive Method of Designing Reinforced Concrete Sections.—III.*

By J. RYGOL, B.Sc.(Eng.).

ELASTIC (MODULAR-RATIO) METHOD (*continued*).

Rectangular Sections.—Separate charts, namely Nomograms Nos. 3 and 4 (pages 268 and 270), are provided for rectangular sections. These charts enable solutions for such sections, when, reinforced in tension and compression, to be obtained even more rapidly and simply than by using Nomograms Nos. 1 and 2 (see this journal for July, 1961).

The equations on which these nomograms are based are as follows.

Nomogram No. 3.— $$C_t = \frac{n(3-n)}{6} + \frac{(n-\beta')(1-\beta')}{n}(m-1)p'.$$

Nomogram No. 4.— $$C_c = -\frac{n(n-3\beta')}{6} + \frac{(1-n)(1-\beta')}{n}mp.$$

The following examples show the application of Nomograms Nos. 3 and 4.

EXAMPLE No. 9. Given.—Rectangular section. $h = 30$ in. $b = 18$ in. $g = g' = 2$ in. $N = 80{,}000$ lb. (compressive). $e = 35$ in. Permissible $f_c = 1200$ lb. per sq. in. $f_s = 20{,}000$ lb. per sq. in. $m = 15$; hence $n_0 = 0{\cdot}473$. (This is Example No. 2 which was worked out by using Nomograms Nos. 1 and 2.)

To determine.—A_s (and A_s' if required).

Solution.—As in Example No. 2, $d = 30 - 2 = 28$ in.; $\beta = \beta' = \frac{2}{28} = 0{\cdot}07$.

$$e_t = 35 + \frac{30}{2} - 2 = 48 \text{ in.}; \quad e_c = 35 - \frac{30}{2} + 2 = 22 \text{ in.}$$

$M_t = 80{,}000 \times 48 = 3{,}840{,}000$ in.-lb.; $M_c = 80{,}000 \times 22 = 1{,}760{,}000$ in.-lb.

$$C_t = \frac{3{,}840{,}000}{1200 \times 18 \times 28^2} = 0{\cdot}227 \quad \text{and} \quad C_c = \frac{1{,}760{,}000}{1200 \times 18 \times 28^2} = 0{\cdot}104.$$

From Nomogram No. 3 (with $C_t = 0{\cdot}227$, $n = 0{\cdot}473$, $\beta' = 0{\cdot}07$), $(m-1)p' = 0{\cdot}035$.
From Nomogram No. 4 (with $C_c = 0{\cdot}104$, $n = 0{\cdot}473$, $\beta' = 0{\cdot}07$), $mp = 0{\cdot}121$.
Hence $A_s = 4{\cdot}07$ sq. in. and $A_s' = 1{\cdot}26$ sq. in.

EXAMPLE No. 10. Given.—Rectangular section. $N = 30{,}500$ lb. (compressive). $e = 50$ in. Permissible $f_c = 1000$ lb. per sq. in. $f_s = 20{,}000$ lb. per sq. in. $m = 15$; hence $n_0 = 0{\cdot}429$, $mp = 0{\cdot}15$, $(m-1)p' = 0{\cdot}10$, $g = g' = 2$ in.

To determine.—d and b.

Solution.—Assume $\beta = \beta' = 0{\cdot}10$. From Nomogram No. 3 (with $[m-1]p' = 0{\cdot}10$, $n = 0{\cdot}429$, $\beta' = 0{\cdot}10$), $C_t = 0{\cdot}253$. From Nomogram No. 4 (with $mp = 0{\cdot}15$, $n = 0{\cdot}429$, $\beta' = 0{\cdot}10$), $C_c = 0{\cdot}170$. Thus

$$\varepsilon_0 = \frac{C_t + C_c\left(\frac{1-\beta}{2}\right)}{C_t - C_c} = \frac{0{\cdot}253 + 0{\cdot}170}{0{\cdot}253 - 0{\cdot}170} \times \frac{1 - 0{\cdot}10}{2} = 2{\cdot}29$$

and $$d = \frac{e}{\varepsilon_0} = \frac{50}{2{\cdot}29} = 21{\cdot}8 \text{ in., say } 22 \text{ in.}$$

* Continued from July, 1961.

Medical opinion seems to concur that cement dermatitis is non-contagious and is only likely to occur if a workman is allergic to this particular form of cutaneous disease.

Chrome can be present in cement from various sources, the chief of which are the wearing down of balls of chromium steel in the grinding mills, and the abrasion of chrome-containing refractory bricks in the kiln. Some chrome may also be present in the pulverised coal used as fuel in the kilns. In an extreme case, the cause of the infection was attributed to a worker wearing chrome-tanned gloves when handling cement. The extent to which it is considered that some workmen are allergic to dermatitis is illustrated by the fact that one firm making precast concrete products required each new employee to certify that he had never suffered from the disease.

Conditions in the products industry may be such that workmen handle moulds which are at the same time oily and coated in part with wet concrete or cement grout, a condition which is very severe, especially to a workman who is in any way prone to dermatitis. Enquiries were made recently among several firms making products to determine the extent of the disease in this industry and what precautions were taken. It is encouraging to learn that cement dermatitis is not prevalent; most of the firms stress the importance of personal cleanliness, frequent washing, and a barrier cream applied to clean hands and arms. The effectiveness of barrier creams without previous cleanliness may be problematic but, as was pointed out in the course of the court case cited, the effectiveness in other conditions may yet be proved by the conducting of tests on a scientific basis. Assurance is given by the makers of barrier creams that research on this subject is progressing and that so far it seems evident that the value of such creams should not be under-rated. It is thought that the daily use of barrier creams, although not necessarily providing complete protection against dermatitis, certainly conditions the hands for easier and quicker removal of cement by washing and thereby no doubt helps to lessen the chances of dermatitis developing. It is also important that the skin should be free from cuts and abrasions, or that such injuries should be well covered, for example by wearing rubber gloves.

With continued development in all branches of the manufacturing and constructional industries, there is much hope that the incidence of dermatitis will be reduced even below the low level pertaining today. In the cement industry, where it is at the lowest prevailing level despite what might seem to be conditions conducive to the disease, it is likely to be reduced even more so by modern methods of packing, bulk transport, and dust control. In the constructional industry, automatic mixing and handling of concrete, often by remote control, removes much of the need for men to come in actual contact with wet concrete, although this contact when compacting by vibrators or otherwise does not yet seem to be avoidable. In the products industry, where oily moulds and wet concrete make conditions particularly virulent, some contact is also at present almost unavoidable but, as stated, there is evidence to show that personal cleanliness does much to mitigate, or even to prevent altogether, the onset of this unpleasant disease.

A Practical Comprehensive Method of Designing Reinforced Concrete Sections.—III.*

By J. RYGOL, B.Sc.(Eng.).

ELASTIC (MODULAR-RATIO) METHOD (*continued*).

Rectangular Sections.—Separate charts, namely Nomograms Nos. 3 and 4 (pages 268 and 270), are provided for rectangular sections. These charts enable solutions for such sections, when, reinforced in tension and compression, to be obtained even more rapidly and simply than by using Nomograms Nos. 1 and 2 (see this journal for July, 1961).

The equations on which these nomograms are based are as follows.

Nomogram No. 3.— $$C_t = \frac{n(3-n)}{6} + \frac{(n-\beta')(1-\beta')}{n}(m-1)p'.$$

Nomogram No. 4.— $$C_c = -\frac{n(n-3\beta')}{6} + \frac{(1-n)(1-\beta')}{n}mp.$$

The following examples show the application of Nomograms Nos. 3 and 4.

EXAMPLE No. 9. Given.—Rectangular section. $h = 30$ in. $b = 18$ in. $g = g' = 2$ in. $N = 80{,}000$ lb. (compressive). $e = 35$ in. Permissible $f_c = 1200$ lb. per sq. in. $f_s = 20{,}000$ lb. per sq. in. $m = 15$; hence $n_0 = 0{\cdot}473$. (This is Example No. 2 which was worked out by using Nomograms Nos. 1 and 2.)

To determine.—A_s (and A_s' if required).

Solution.—As in Example No. 2, $d = 30 - 2 = 28$ in.; $\beta = \beta' = \frac{2}{28} = 0{\cdot}07$.

$$e_t = 35 + \frac{30}{2} - 2 = 48 \text{ in.}; \quad e_c = 35 - \frac{30}{2} + 2 = 22 \text{ in.}$$

$$M_t = 80{,}000 \times 48 = 3{,}840{,}000 \text{ in.-lb.}; \quad M_c = 80{,}000 \times 22 = 1{,}760{,}000 \text{ in.-lb.}$$

$$C_t = \frac{3{,}840{,}000}{1200 \times 18 \times 28^2} = 0{\cdot}227 \quad \text{and} \quad C_c = \frac{1{,}760{,}000}{1200 \times 18 \times 28^2} = 0{\cdot}104.$$

From Nomogram No. 3 (with $C_t = 0{\cdot}227$, $n = 0{\cdot}473$, $\beta' = 0{\cdot}07$), $(m-1)p' = 0{\cdot}035$.
From Nomogram No. 4 (with $C_c = 0{\cdot}104$, $n = 0{\cdot}473$, $\beta' = 0{\cdot}07$), $mp = 0{\cdot}121$.
Hence $A_s = 4{\cdot}07$ sq. in. and $A_s' = 1{\cdot}26$ sq. in.

EXAMPLE No. 10. Given.—Rectangular section. $N = 30{,}500$ lb. (compressive). $e = 50$ in. Permissible $f_c = 1000$ lb. per sq. in. $f_s = 20{,}000$ lb. per sq. in. $m = 15$; hence $n_0 = 0{\cdot}429$, $mp = 0{\cdot}15$, $(m-1)p' = 0{\cdot}10$, $g = g' = 2$ in.

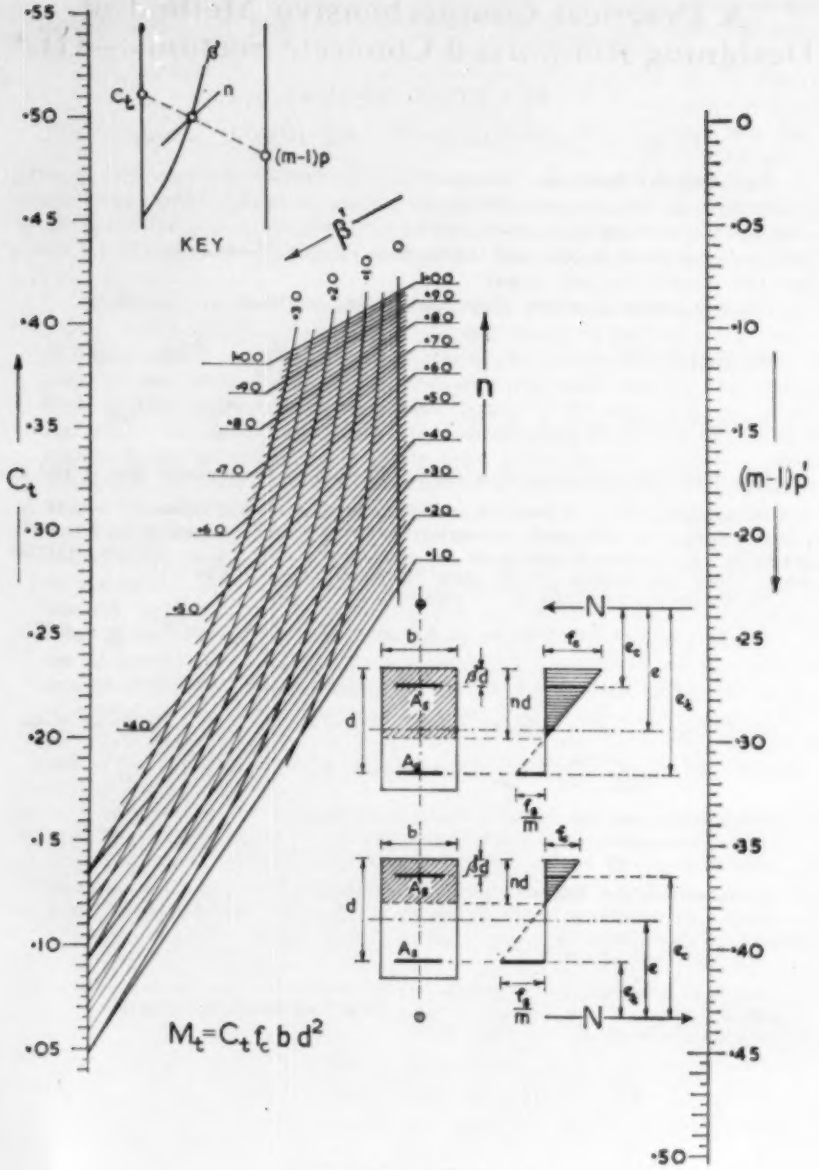
To determine.—d and b.

Solution.—Assume $\beta = \beta' = 0{\cdot}10$. From Nomogram No. 3 (with $[m-1]p' = 0{\cdot}10$, $n = 0{\cdot}429$, $\beta' = 0{\cdot}10$), $C_t = 0{\cdot}253$. From Nomogram No. 4 (with $mp = 0{\cdot}15$, $n = 0{\cdot}429$, $\beta' = 0{\cdot}10$), $C_c = 0{\cdot}170$. Thus

$$\varepsilon_0 = \frac{C_t + C_c\left(\frac{1-\beta}{2}\right)}{C_t - C_c} = \frac{0{\cdot}253 + 0{\cdot}170}{0{\cdot}253 - 0{\cdot}170} \times \frac{1 - 0{\cdot}10}{2} = 2{\cdot}29$$

and $$d = \frac{e}{\varepsilon_0} = \frac{50}{2{\cdot}29} = 21{\cdot}8 \text{ in., say } 22 \text{ in.}$$

* Continued from July, 1961.



Nomogram No. 3.

Checking assumed value of β.— $\beta = 2/22 = 0{\cdot}09$, which is about the value assumed and therefore no further correction is necessary.

$$b = \frac{Ne_t}{C_t f c d^2} = \frac{30{,}500 \times (50 + 10)}{0{\cdot}253 \times 1000 \times 22^2} = 15 \text{ in.}$$

LOAD-FACTOR METHOD.

By the load-factor method a section is designed to resist the bending moment due to the design load multiplied by a load-factor. At failure the distribution of compressive stress across the section adjusts itself so as to enable the member to develop its maximum capacity to resist the applied load. The true distribution of stress in the concrete at failure can be replaced by a uniform stress f_u acting over a depth a $(= \alpha d)$ of the section. The principle of a uniform distribution of stress as the basis of load-factor design has been adopted in the British, American and Russian codes[1] of practice.

The ultimate resistance of a section is controlled by either the yielding of the tension reinforcement (*Fig.* 9), or the crushing of the concrete (*Fig.* 10).

Basic Equations and Factors.

Basic Equations.—The basic equations are

$$N_u = K_u f_u b d \quad . \quad . \quad . \quad . \quad . \quad (1b)$$
$$M_{ut} = C_{ut} f_u b d^2 \quad . \quad . \quad . \quad . \quad . \quad (2b)$$
$$M_{uc} = C_{uc} f_u b d^2 \quad . \quad . \quad . \quad . \quad . \quad (3b)$$

where K_u, C_{ut}, and C_{uc}, are the stress factors for the equivalent uniform concrete stress f_u.

Stress-block Factors.—The stress-block factors at ultimate load

$$D_{cu} = \kappa_{1u} f_u b d,$$
$$z D_{cu} = \kappa_{2u} f_u b d^2,$$
$$z' D_{cu} = \kappa_{3u} f_u b d^2,$$

are $\kappa_{1u} = \nu$, $\kappa_{2u} = \lambda\nu$ and $\kappa_{3u} = \nu(1 - \lambda - \beta')$, where $\nu = \dfrac{A_c}{bd}$ is referred to as the shape coefficient of the section.

Stress-factor Equations.—In the general case the stress-factor equations are

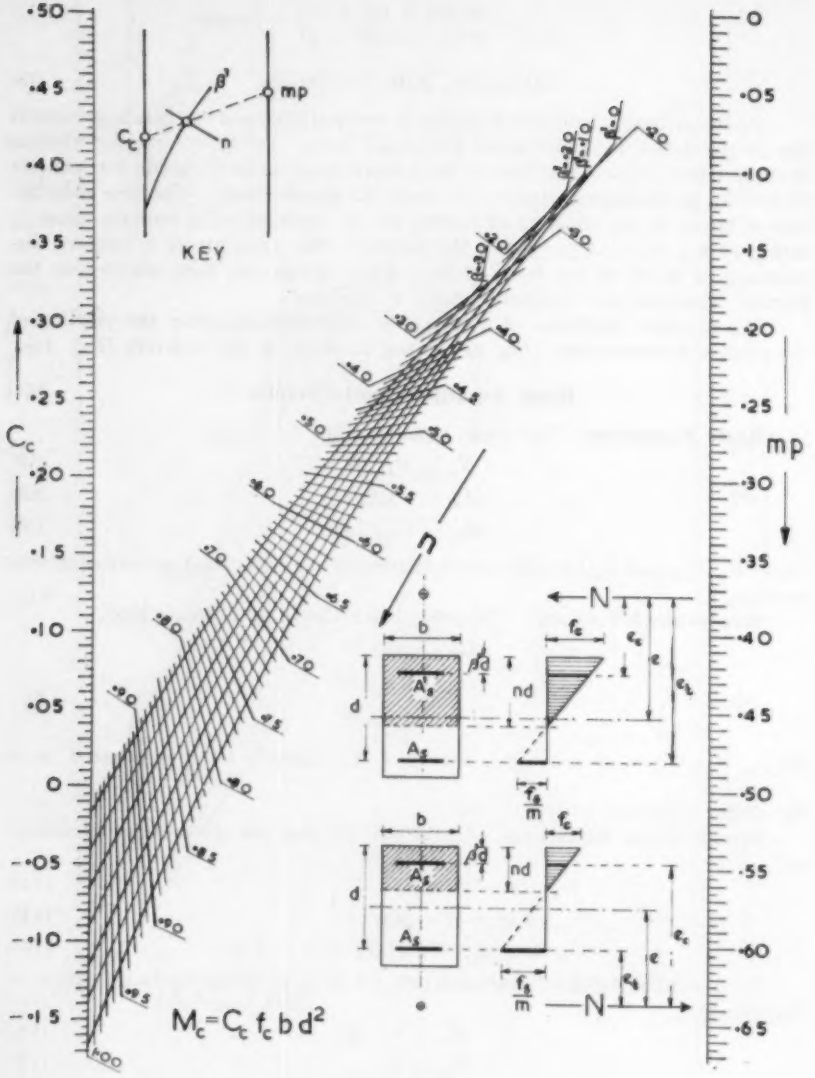
$$K_u = \nu + q' - q \quad . \quad . \quad . \quad . \quad . \quad . \quad (13b)$$
$$C_{ut} = \lambda\nu + (1 - \beta')q' \quad . \quad . \quad . \quad . \quad . \quad . \quad (14b)$$
$$C_{uc} = -\nu(1 - \lambda - \beta') + (1 - \beta')q \quad . \quad . \quad . \quad (15b)$$

For a section reinforced in tension only (i.e. $q' = 0$), the stress-factor equations simplify to

$$\bar{K}_u = \nu - \bar{q} \quad . \quad . \quad . \quad . \quad . \quad . \quad (13c)$$
$$\bar{C}_{ut} = \lambda\nu \quad . \quad . \quad . \quad . \quad . \quad . \quad (14c)$$

and the basic equations become

$$\bar{N}_u = \bar{K}_u f_u b d \quad . \quad . \quad . \quad . \quad . \quad (1c)$$
$$\bar{M}_{ut} = \bar{C}_{ut} f_u b d^2 \quad . \quad . \quad . \quad . \quad . \quad (2c)$$



Nomogram No. 4.

Failure Controlled by Yielding of Tension Reinforcement.

In the case of failure being controlled by yielding of the tension reinforcement (*Fig.* 9), $f_s = f_y$ at failure.

If the compression reinforcement has yielded, $f_s' = f_y'$, which is the case if $\varepsilon_s' > \varepsilon_y'$ where ε_s' can be calculated using $\varepsilon_s' = \varepsilon_u\left(\frac{n-\beta'}{n}\right)$ and the stress-factor equations become

$$K_u = v + q_y' - q_y \quad . \quad . \quad . \quad . \quad . \quad . \quad (13d)$$

$$C_{ut} = \lambda v + (1-\beta')q_y' \quad . \quad . \quad . \quad . \quad . \quad (14d)$$

$$C_{uc} = -v(1-\lambda-\beta') + (1-\beta')q_y \quad . \quad . \quad . \quad (15d)$$

Simple Bending.—For simple bending $N_u = 0$ and $M_{ut} = M_{uc} = M_u$, therefore $K_u = 0$, $C_{ut} = C_{uc} = C_u$, and equation (13*d*) becomes $v + q_{yb}' - q_{yb} = 0$.

Section Reinforced for Tension Only.—Since $q_y' = 0$, therefore $K_u = v - \bar{q}_y$, $C_{ut} = \lambda v$, and the basic equations are as given by equations (1*c*) and (2*c*).

Section Reinforced for Tension and Compression.

$$q_y' = \frac{C_{ut} - C_{ut}}{1-\beta'}$$

$$q_y = \bar{q}_{yb} + q_y' - K_u$$

where $\bar{q}_{yb} = v$.

Failure Controlled by Crushing of Concrete.

In the case of failure being controlled by crushing of the concrete (*Fig.* 10), the tension reinforcement is stressed elastically. From the assumption of linear strain distribution, $n = \frac{x}{d} = \frac{\varepsilon_u}{\varepsilon_s + \varepsilon_u}$.

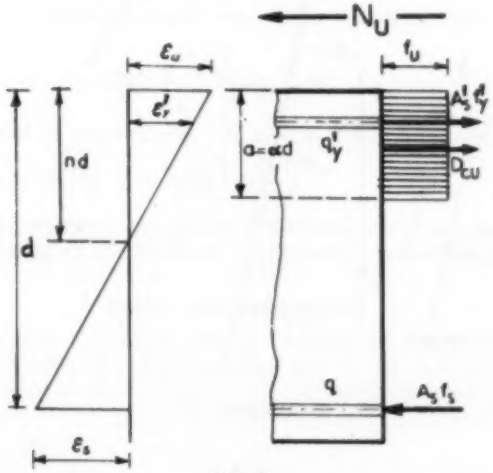
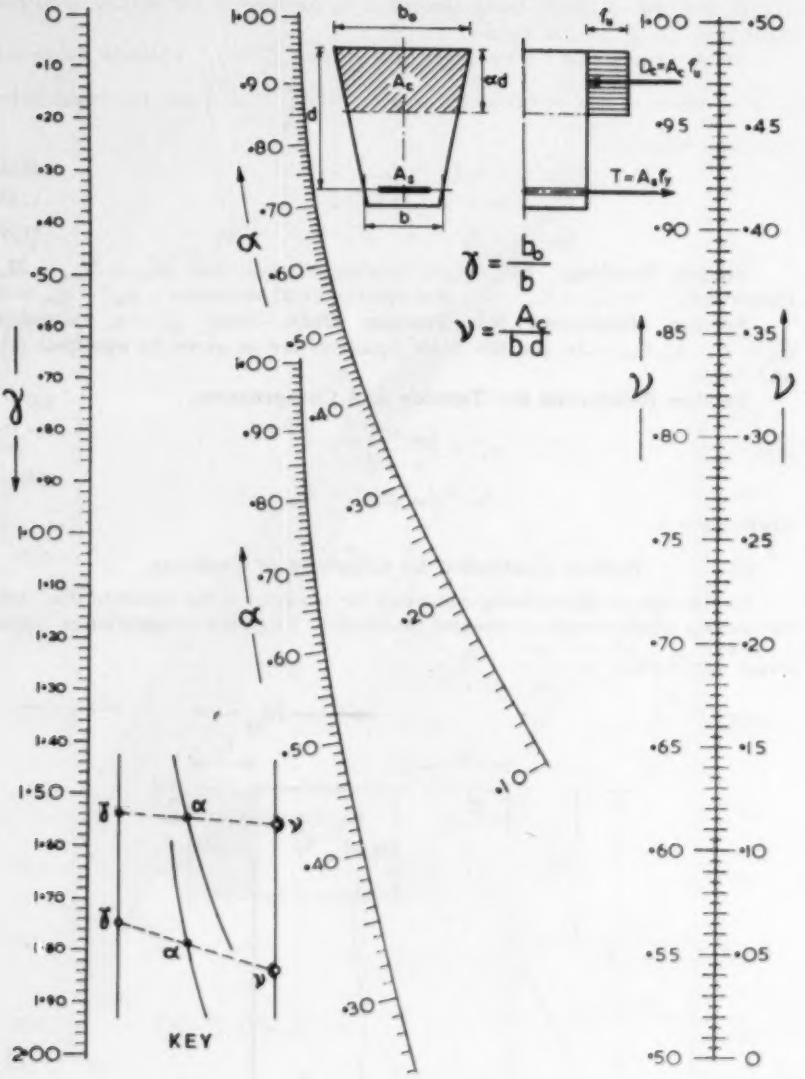


Fig. 9.



Nomogram No. 5.

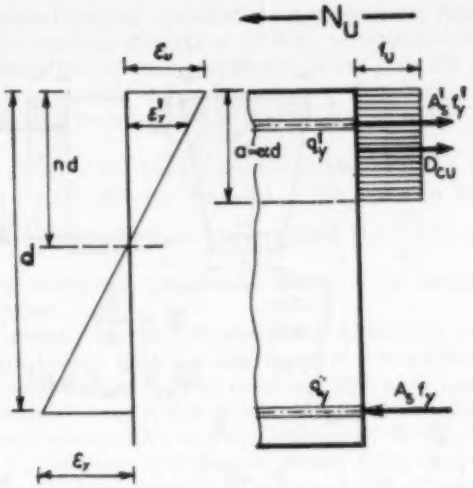


Fig. 10.

The tension-reinforcement index can be written in the form

$$q = m_u p\left(\frac{1-n}{n}\right) \quad . \quad . \quad . \quad . \quad . \quad (18)$$

If the depth of the equivalent rectangular stress block is assumed to equal 0·85 of the depth to the neutral axisl[1], [2], that is $\alpha = 0{\cdot}85n$, equation (18) becomes $q = m_u p\left(\frac{0{\cdot}85-\alpha}{\alpha}\right)$.

Thus, if the compression reinforcement has yielded, equation (13*b*) can be rewritten as

$$v - \left(\frac{0{\cdot}85-\alpha}{\alpha}\right)m_u p = K_u - q_y' \quad . \quad . \quad . \quad . \quad (19)$$

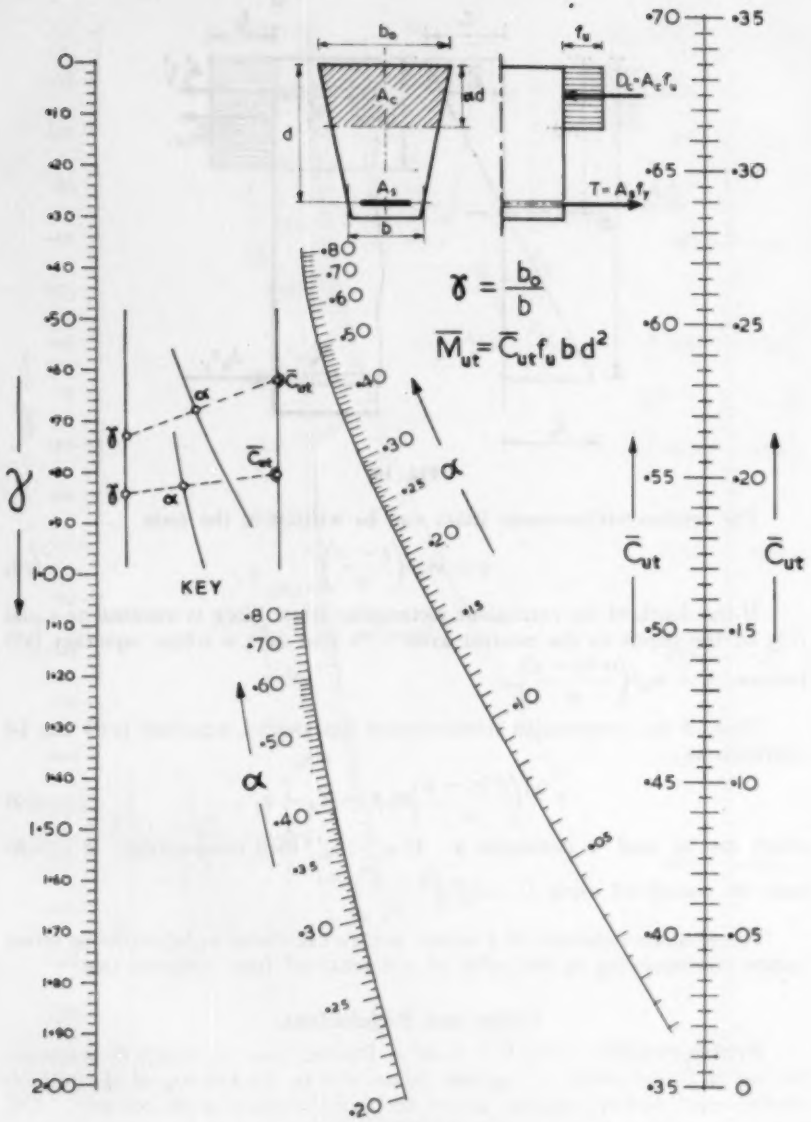
which can be used to determine α. If $\varepsilon_s' < \varepsilon_y'$, then compatibility of strains must be considered using $f_s' = \varepsilon_u E_s\left(\frac{n-\beta'}{n}\right)$.

The ultimate resistance of a section is then calculated as before, using stress factors corresponding to the value of α determined from equation (19).

Codes and Regulations.

British Practice.—The B.S. Code of Practice No. 114 (1957) recommends the use of a load factor of 2 against failure due to the yielding of the tension reinforcement, and of 3 against failure due to the crushing of the concrete. The reason for a higher factor against crushing of the concrete is due to the extreme undesirability of this form of failure.

The crushing strength of the concrete in bending, compatible with the



Nomogram No. 6.

assumption of equivalent uniform distribution of compressive stress, is taken to be two-thirds of the crushing strength u of 6-in. works-cubes at twenty-eight days. Thus, at failure, the uniform compressive stress f_u in the concrete when the tension reinforcement yields is $\frac{2}{3} \times \frac{2}{3}u = 0{\cdot}45u$. The depth of the concrete in compression should not be considered to exceed one-half of the effective depth (that is $\alpha < 0{\cdot}50$).

At failure, the stress in the tension reinforcement should be neither greater than 60,000 lb. per square inch nor exceed f_y. The stress in the compression reinforcement should be neither greater than $100{,}000\left(1 - \frac{\beta'}{\alpha}\right)$ lb. per square inch nor exceed f_y'. The maximum compression strain in the concrete should not exceed 0·0033 at failure.

American Practice.—In the " Report of the ACI-ASCE Joint Committee on Ultimate Strength Design, 1955 ", a load factor of 2 is specified for members subjected to either axial load or bending combined with axial load, and a factor of 1·8 for beams and girders subjected to bending where the axial load is negligible. At failure the uniform compressive stress f_u is assumed to be 0·85 of the compressive strength f_{cyl} of 6-in. cylinders at twenty-eight days. If $f_{cyl} = \frac{2}{3}u$, when related to the crushing strength of a 6-in. cube at twenty-eight days, $f_u = 0{\cdot}64u$ approximately. The ratio α/n is taken to equal 0·85 for concrete cylinder strength up to 5000 lb. per square inch ($u = 6667$ lb. per square inch), and reduced by 0·05 for each 1000 lb. per square inch of cylinder strength in excess of 5000 lb. per square inch (or by 0·05 for each 1333 lb. per square inch of cube strength in excess of 6667 lb. per square inch approximately). The maximum compressive strain in the concrete at failure is limited to 0·003.

When $f_s < f_y$, f_s is assumed to equal $E_s \times \varepsilon_s$ (where $E_s = 30 \times 10^6$ lb. per square inch). When the steel strain exceeds f_y, the stress is considered to be independent of strain and equal to the yield point stress.

To ensure against sudden compression failure, the Code requires that in flexural members

$$\bar{q}_{vb} \leqslant 0{\cdot}40.$$

A simple expression for the limiting value of $\bar{q}_{vb}$ is proposed in reference [2]:

$$\bar{q}_{vb} \leqslant \frac{80}{f_y}.$$

Russian Practice.—In the Standards and Technical Regulations for the Design of Reinforced Concrete Structures (N & TU-3-49), the assumed load-factor varies from 1·5 to 2·2 depending on the type of member (column, beam, etc.), the nature of loading (subsidiary loads, main loads, etc.), the live load/dead load, and the method of computation employed (" exact " or " approximate " method of analysis, consideration of secondary effects, etc.). The crushing strength of the concrete is determined by 8-in. cubes, u_8. The compressive resistance of members in direct compression is based on the prism strength, u_{pr}, which is related to the standard cube strength, u_8, by

$$u_{pr} = \frac{18{,}500 + u_8}{20{,}600 + 3u_8} u_8.$$

Assuming that the crushing strength of a 6-in. cube is approximately 1·08 times the crushing strength of an 8-in. cube, $u_{pr} = \frac{20{,}000 + u}{24{,}000 + 3u} u$. In these equations the values of u, u_8, and u_{pr}, are in lb. per square inch.

For failure controlled by the yielding of the tension reinforcement $f_u = 1{\cdot}25u_{pr}$.

For failure controlled by the crushing of the concrete $f_u = u_{pr}$.

Tests carried out by the Moscow Research Institute for Industrial Structures with members of various shapes subjected to eccentric loading have shown that the mode of failure will be that caused by yielding of the tension reinforcement if

$$Z_c \leqslant 0{\cdot}80 Z_c', \quad . \quad . \quad . \quad . \quad . \quad (20)$$

where Z_c is the first moment of area of the compression zone of concrete about the centroid of the tension reinforcement, and Z_c' is the first moment of area of the entire effective concrete section about the centroid of the tension reinforcement. Equation (20) written in non-dimensional form becomes

$$\bar{C}_{ut} \leqslant 0{\cdot}80 \bar{C}_{ut}'$$

where $\bar{C}_{ut}'$ is the value of $\bar{C}_{ut}$ corresponding to $\alpha = 1$. For members subjected to simple bending the Code stipulates the more stringent condition $\bar{C}_{ut} \leqslant 0{\cdot}75\bar{C}_{ut}'$, which ensures that the mode of failure is always that caused by yielding of the tension reinforcement. In addition to the condition limiting the value of $\bar{C}_{ut}$, a section reinforced for tension and compression must satisfy the following conditions:

$$\beta' \leqslant \frac{\alpha}{2} \quad \text{or} \quad \beta' \leqslant 1 - \frac{\bar{C}_{ut}}{\nu} \quad . \quad . \quad . \quad . \quad (21)$$

and

$$M_{ut} \leqslant \bar{C}_{ut}' f_u b d^2. \quad . \quad . \quad . \quad . \quad . \quad (22)$$

Equation (21) ensures that the compression reinforcement attains the yield-point stress at failure by limiting the depth of this reinforcement to not more than half the depth of the rectangular stress block, and by ensuring that this reinforcement is positioned above the resultant of all compressive stresses. Equation (22) limits the amount of reinforcement in a section for economical reasons, and also because of the undesirability of a small, heavily reinforced, concrete section.

Application of Method.

The examples which follow illustrate the application of the method to comply with British, American and Russian practice. Nomograms Nos. 5 and 6 (pages 272 and 274) are given for ultimate-load design of trapezoidal sections (*Fig.* 8, Part II), which contain as particular cases the rectangular section ($\gamma = 1$) and the triangular section ($\gamma = 0$). The governing equations for these nomograms are:

Nomogram No. 5.— $\nu = \alpha - (1 - \gamma)\frac{\alpha(2 - \alpha)}{2}$.

Nomogram No. 6.— $\bar{C}_{ut} = \frac{\alpha(2 - \alpha)}{2} - (1 - \gamma)\frac{\alpha(3 - 3\alpha + \alpha^2)}{3}$.

By substituting $\alpha = 1$ in the latter equation, $\bar{C}_{ut}' = \frac{1 + 2\gamma}{6}$. Assuming the limiting value of $\bar{C}_{ut}$ is $0.75\bar{C}_{ut}'$

$$\bar{C}_{ut_a} = \frac{1 + 2\gamma}{8}.$$

Examples.

EXAMPLE No. 11. Given.—Trapezoidal section. $b = 12$ in. $b_0 = 18$ in. $d = 27$ in. $M = 2{,}000{,}000$ in.-lb. $u = 3300$ lb. per sq. in. $f_y = 40{,}000$ lb. per sq. in.

To determine.—A_s (and A_s' if required).

Solution.—(i) British practice.

$$\gamma = \frac{b_0}{b} = \frac{18}{12} = 1.5; \qquad M_u = 2M = 2 \times 2{,}000{,}000 = 4{,}000{,}000 \text{ in.-lb.}$$

$$f_u = 0.45u = 0.45 \times 3300 = 1485 \text{ lb. per sq. in.}$$

$$r_y = \frac{f_y}{f_u} = \frac{40{,}000}{1485} = 26.9; \qquad \bar{C}_{ut} = \frac{4{,}000{,}000}{1485 \times 12 \times 27^2} = 0.308.$$

From Nomogram No. 6 (with $\gamma = 1.5$, $\bar{C}_{ut} = 0.308$), $\alpha = 0.242$, which is less than one-half of the effective depth; hence compression reinforcement is not required.

From Nomogram No. 5 (with $\gamma = 1.5$, $\alpha = 0.242$), $p = 0.350$; hence

$$\bar{p}_b = \frac{\bar{q}_{yb}}{r_y} = \frac{p}{r_y} = \frac{0.350}{26.9} = 0.0130 \quad \text{and}$$

$$A_s = 0.0130 \times 12 \times 27 = 4.22 \text{ sq. in.}$$

(ii) Russian practice. (Assuming $k = 2.0$.)

$$u_{pr} = \frac{20{,}000 + 3300}{24{,}000 + (3 \times 3300)} \times 3300 = 2270 \text{ lb. per sq. in.}$$

$$f_u = 1.25 \times 2270 = 2840 \text{ lb. per sq. in.}$$

$$r_y = \frac{40{,}000}{2840} = 14.06; \qquad \bar{C}_{ut} = \frac{4{,}000{,}000}{2840 \times 12 \times 27^2} = 0.161.$$

From Nomogram No. 6 (with $\gamma = 1.5$, $\bar{C}_{ut} = 0.161$), $\alpha = 0.115$.

From Nomogram No. 5 (with $\gamma = 1.5$, $\alpha = 0.115$), $p = 0.170$; hence

$$\bar{p}_b = \frac{0.170}{14.06} = 0.0121 \quad \text{and}$$

$$A_s = 0.0121 \times 12 \times 27 = 3.92 \text{ sq. in.}$$

EXAMPLE No. 12. Given.—Trapezoidal section. $d = 20$ in. $b = 12$ in. $b_0 = 9$ in. $u = 4500$ lb. per sq. in. $f_y = 40{,}000$ lb. per sq. in.

To determine.—Ultimate bending resistance and amount of reinforcement required if section is reinforced for tension only.

Solution.—

$$\gamma = \frac{b_0}{b} = \frac{9}{12} = 0.75.$$

(i) British practice.

$$f_u = 0.45 \times 4500 = 2000 \text{ lb. per sq. in.}$$

$$r_y = \frac{40{,}000}{2000} = 20.$$

The maximum depth of the concrete compression stress block is taken to be one-half of the effective depth, $\alpha_{max.} = 0.50$.

From Nomogram No. 6 (with $\gamma = 0.75$, $\alpha = 0.50$), $\bar{C}_{ut} = 0.302$,

$$\bar{M}_{ut} = 0.302 \times 2000 \times 12 \times 20^2 = 2{,}900{,}000 \text{ in.-lb.}$$

From Nomogram No. 5 (with $\gamma = 0{\cdot}75$, $\alpha = 0{\cdot}50$), $\nu = \bar{q}_{yb} = 0{\cdot}406$,

$$A_s = \frac{0{\cdot}406}{20} \times 12 \times 20 = 4{\cdot}87 \text{ sq. in.}$$

(ii) American practice.

$$f_u = 0{\cdot}64 \times 4500 = 2880 \text{ lb. per sq. in.}$$

$$r_y = \frac{40{,}000}{2880} = 13{\cdot}9.$$

Using the limiting value $\bar{q}_{yb} = 0{\cdot}40$;

$$A_s = \frac{0{\cdot}40}{13{\cdot}9} \times 12 \times 20 = 6{\cdot}92 \text{ sq. in.}$$

From Nomogram No. 5 (with $\gamma = 0{\cdot}75$, $\nu = 0{\cdot}40$), $\alpha = 0{\cdot}495$, and from Nomogram No. 6 (with $\gamma = 0{\cdot}75$, $\alpha = 0{\cdot}495$), $\bar{C}_{ut} = 0{\cdot}299$,

$$\bar{M}_{ut} = 0{\cdot}299 \times 2880 \times 12 \times 20^2 = 4{,}130{,}000 \text{ in.-lb.}$$

(iii) Russian practice.

$$u_{pr} = \frac{20{,}000 + 4500}{24{,}000 + (3 \times 4500)} \times 4500 = 2930 \text{ lb. per sq. in.}$$

$$f_u = 1{\cdot}25 \times 2930 = 3660 \text{ lb. per sq. in.}$$

$$r_y = \frac{40{,}000}{3660} = 10{\cdot}92; \quad \bar{C}_{ut_0} = \frac{1 + 2\gamma}{8} = \frac{1 + (2 \times 0{\cdot}75)}{8} = 0{\cdot}312.$$

$$\bar{M}_{ut} = 0{\cdot}312 \times 3660 \times 12 \times 20^2 = 5{,}480{,}000 \text{ in.-lb.}$$

From Nomogram No. 6 (with $\gamma = 0{\cdot}75$, $\bar{C}_{ut} = 0{\cdot}312$), $\alpha = 0{\cdot}520$.
From Nomogram No. 5 (with $\gamma = 0{\cdot}75$, $\alpha = 0{\cdot}520$), $\nu = \bar{q}_{yb} = 0{\cdot}422$, hence

$$A_s = \frac{0{\cdot}422}{10{\cdot}92} \times 12 \times 20 = 9{\cdot}25 \text{ sq. in.}$$

EXAMPLE No. 13. Given.—Trapezoidal section. $b = 10$ in. $b_0 = 12$ in. Assume $\bar{p} = 1{\cdot}2$ per cent. $M = 520{,}000$ in.-lb. $u = 6000$ lb. per sq. in. $f_y = 60{,}000$ lb. per sq. in.

To determine.—d and A_s in accordance with British Code recommendations.

Solution.—

$$\gamma = \frac{b_0}{b} = \frac{12}{10} = 1{\cdot}20; \quad M_u = 2 \times 520{,}000 = 1{,}040{,}000 \text{ in.-lb.}$$

$$f_u = 0{\cdot}45 \times 6000 = 2700 \text{ lb. per sq. in.}$$

$$\nu = \bar{q}_{yb} = \frac{1{\cdot}2}{100} \times \frac{60{,}000}{2700} = 0{\cdot}267$$

From Nomogram No. 5 (with $\gamma = 1{\cdot}2$, $\nu = 0{\cdot}267$), $\alpha = 0{\cdot}226$.
From Nomogram No. 6 (with $\gamma = 1{\cdot}2$, $\alpha = 0{\cdot}226$), $\bar{C}_{ut} = 0{\cdot}238$.

$$d = \sqrt{\frac{1{,}040{,}000}{0{\cdot}238 \times 2700 \times 10}} = 12{\cdot}7 \text{ in.}$$

$$A_s = \frac{1{\cdot}2}{100} \times 10 \times 12{\cdot}7 = 1{\cdot}53 \text{ sq. in.}$$

EXAMPLE No. 14. Given.—Rectangular section. $h = 30$ in. $b = 18$ in. $g = g' = 2$ in. $N = 80{,}000$ lb. (compressive). $e = 35$ in. $k = 2$. $u = 4750$ lb. per sq. in. $f_y = f_y' = 40{,}000$ lb. per sq. in.

To determine.—A_s (and A_s' if required).

Solution.—$d = 30 - 2 = 28$ in.; $\beta = \beta' = \frac{2}{28} = 0{\cdot}07$.

$$e_t = 35 + \frac{30}{2} - 2 = 48 \text{ in.}; \quad e_c = 35 - \frac{30}{2} + 2 = 22 \text{ in.}$$

$M_{ut} = 2 \times 80{,}000 \times 48 = 7{,}680{,}000$ in.-lb.
$M_{uc} = 2 \times 80{,}000 \times 22 = 3{,}520{,}000$ in.-lb.
$N_u = 2 \times 80{,}000 = 160{,}000$ lb.

(i) British practice.

$$f_u = 0{\cdot}45 \times 4750 = 2140 \text{ lb. per sq. in.}; \quad r_y = \frac{40{,}000}{2140} = 18{\cdot}7.$$

$$K_u = \frac{160{,}000}{2140 \times 18 \times 28} = 0{\cdot}144.$$

$$C_{ut} = \frac{7{,}680{,}000}{2140 \times 18 \times 28^2} = 0{\cdot}254.$$

From Nomogram No. 6 (with $\gamma = 1$, $C_{ut} = 0{\cdot}254$), $\alpha = 0{\cdot}300$, which is less than 0·50 and therefore compression reinforcement is not required.
From Nomogram No. 5 (with $\gamma = 1$, $\alpha = 0{\cdot}300$), $\nu = 0{\cdot}300$; hence

$$\bar{q}_y = 0{\cdot}300 - 0{\cdot}144 = 0{\cdot}156 \quad \text{and} \quad A_s = \frac{0{\cdot}156}{18{\cdot}7} \times 18 \times 28 = 4{\cdot}20 \text{ sq. in.}$$

(ii) American practice.

$$f_u = 0{\cdot}64 \times 4750 = 3040 \text{ lb. per sq. in.}; \quad r_y = \frac{40{,}000}{3040} = 13{\cdot}15.$$

$$K_u = \frac{160{,}000}{3040 \times 18 \times 28} = 0{\cdot}104.$$

$$C_{ut} = \frac{7{,}680{,}000}{3040 \times 18 \times 28^2} = 0{\cdot}179.$$

From Nomogram No. 6 (with $\gamma = 1$, $C_{ut} = 0{\cdot}179$), $\alpha = 0{\cdot}198$.
From Nomogram No. 5 (with $\gamma = 1$, $\alpha = 0{\cdot}198$), $\nu = 0{\cdot}198$; hence

$$\bar{q}_y = 0{\cdot}198 - 0{\cdot}104 = 0{\cdot}094 \quad \text{and} \quad A_s = \frac{0{\cdot}094}{13{\cdot}15} \times 18 \times 28 = 3{\cdot}61 \text{ sq. in.}$$

(iii) Russian practice.

$$f_u = u_{pr} = \frac{20{,}000 + 4750}{24{,}000 + (3 \times 4750)} \times 4750 = 3070 \text{ lb. per sq. in.}$$

$$r_y = \frac{40{,}000}{3070} = 13{\cdot}03.$$

$$K_u = \frac{160{,}000}{3070 \times 18 \times 28} = 0{\cdot}103.$$

$$C_{ut} = \frac{7{,}680{,}000}{3070 \times 18 \times 28^2} = 0{\cdot}177.$$

From Nomogram No. 6 (with $\gamma = 1$, $C_{ut} = 0{\cdot}177$), $\alpha = 0{\cdot}195$.
From Nomogram No. 5 (with $\gamma = 1$, $\alpha = 0{\cdot}195$), $\nu = 0{\cdot}195$; hence

$$\bar{q}_y = 0{\cdot}195 - 0{\cdot}103 = 0{\cdot}092 \quad \text{and} \quad A_s = \frac{0{\cdot}092}{13{\cdot}03} \times 18 \times 28 = 3{\cdot}54 \text{ sq. in.}$$

BIBLIOGRAPHICAL REFERENCES.

1.—British Standard Code of Practice No. 114 (1957). "The Structural Use of Reinforced Concrete in Buildings."

Report of the ACI-ASCE Joint Committee on Ultimate Strength Design, 1955.

N and TU-3-49, Standards and Technical Regulations for the Design of Reinforced Concrete Structures. Issued by ZNIPS, the Central Research Institute for Industrial Structures, Moscow, and confirmed by the Ministry of Works of the U.S.S.R.

2.—"Rectangular Concrete Stress Distribution in Ultimate Strength Design" by A. H. Mattock, L. B. Kriz and E. Hognestad. Journal of the American Concrete Institute, Vol. 32, No. 8, February 1961.

(*To be continued.*)

Book Reviews.

"The Mechanics of Engineering Soils." By P. L. Capper and W. Fisher Cassie. (London: E. & F. N. Spon. Third Edition. 1960. Price 30s.)

THIS new edition follows an earlier revised edition and several reprintings so that it is hardly necessary to state that the popularity of this edition is likely to be at least equal to that of the previous editions. For those who are not familiar with this book, it is well to state that it is one of the most concise books on soil mechanics, and deals with classification of soils, particle-size distribution, moisture determination, liquid and plastic limits, permeability, compressibility, consolidation, shearing strength, and the use of Mohr's circle. The application of soil mechanics and earth-pressure theories to active and passive pressures, and to rotational slips and other forms of foundation failure are considered. Settlement, stabilisation of soils, the design of roads, and drainage are also covered.

It is an excellent review of the subject, especially for students, but since it is not possible to be complete as well as concise, the experienced engineer is not likely to find all that is needed on some aspects of the subject; it can be pleaded, however, that the need is for concise and informative books for the younger engineer, there being a vast amount of more advanced publications and technical papers on soil mechanics. Some sections of the book seem to be the best treatments, in reasonably short lengths, that have so far been produced. No doubt another edition will be required in due course and, when that occurs, this reviewer would suggest the section about the resistance to penetration and safe loads on impact-driven piles might also include reference to the recent work of Mr. Bullen, and to Mr. E. A. Smith on the stress-wave theory; this theory may have undermined confidence in the type of impact formula mentioned in the book, especially in the case of long piles.—D. H. L.

"Sell's Building and Civil Engineering Trades List, 1961" and "Supplement." (London: Business Dictionaries Ltd. Price 40s.)

THE format of this directory conforms with the revised arrangement adopted in the 1960 edition by providing thumb indexing to the nine sections into which the volume is divided. The entries in each section are arranged alphabetically under the type of equipment or product. An alphabetical supplement is now issued for the first time giving the names, addresses and telephone numbers of all the companies entered in the parent volume, excepting builders' merchants and building contractors. Used in conjunction, the two directories provide rapid reference to most companies connected with the building and civil engineering industries.

Bulletins Received.

"Plane Elastic Systems." By L. M. Milne-Thompson. (Berlin: Springer-Verlag. 1960. In English. No price stated.)

"Studies of Disintegrated Concrete—Part 1." By G. M. Idorn. (Copenhagen: The Danish National Institute of Building Research. 1961. In English. Price 12 kr.)

"Crack Formation Due to Shrinkage of Reinforced Concrete." By S. T. A. Odman. (Stockholm: Swedish Cement and Concrete Research Institute. RILEM Bulletin No. 9. 1961. In English. Price 2 kr.)

"The Bending of the Over-reinforced Concrete Beams with Rectangular Cross Section." By L. Mehto. (Helsinki: Finnish State Institute for Technical Research. 1961. In Finnish with a summary in English. No price stated.)

"Soil Stabilization by Admixing Portland Cement." (Washington, D.C.: Highway Research Board. 1960. Price 1.20 dollars.)

"Road Roughness and Skidding Measurements: 1960." (Washington, D.C.: Highway Research Board. 1960. Price 1 dollar.)

"Report on the Experimental Performance of Different Types of Base Courses for Roads Under Adverse Moisture Conditions Tested on the Road Test Track at Majherhat, Alipore, Calcutta (1949-1958)." (New Delhi: Government of India Ministry of Transport and Communications, Department of Transport. 1960. Price 10s.)

"An Analysis of the Cost of Road Improvement Schemes." By R. F. F. Dawson. (London: H.M.S.O. Road Research Laboratory. 1961. Price 1s. 9d.)

"The Use and Control of Vegetation on Roads and Airfields Overseas." By K. E. Clare. (London: H.M.S.O. Road Research Laboratory. 1961. Price 3s. 6d.)

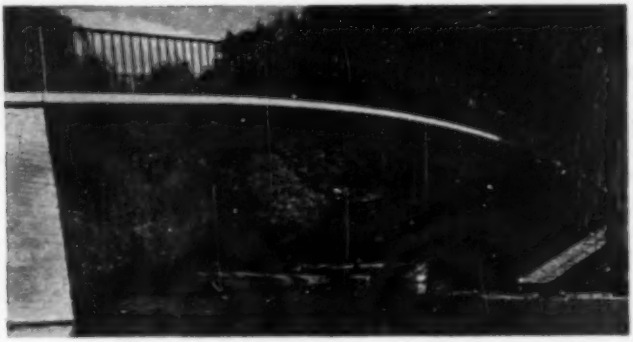


FIG. 1.—GARRET HOSTEL BRIDGE, CAMBRIDGE.

A Prestressed Concrete Frame Bridge at Cambridge.

THE new Garret Hostel Bridge (*Fig.* 1) over the River Cam at Cambridge is a prestressed concrete portal-frame structure which was completed recently and replaces a former cast-iron bridge. The clear span is 80 ft. and the width is 14 ft. Although the bridge is primarily a footbridge, it is designed for the passage occasionally of private cars. The architects required that the central section of the structure should be shallow; a section modulus of 1·43 ft.³ was the maximum available. A simple beam structure was therefore impracticable and consideration of the foundations precluded an arch. A portal frame offered an intermediate solution, the proportions being chosen to provide sufficient stiffness at the crown without a large horizontal thrust. The depth of the structural member at the crown is 1 ft. 9 in. The general arrangement of the bridge and some details are shown in *Fig.* 2 (pages 282 and 283) and *Fig.* 4 (page 284).

Foundations.

The ground at the site comprises soft mud 10 ft. to 13 ft. below water-level overlying a bed of gravel 18 in. to 36 in. thick which overlies a stratum of uniform blue gault clay which extends to a great depth. Laboratory tests on undisturbed samples of the clay predicted a bearing capacity of about 6½ tons per square foot based on a shearing strength of about 0·7 tons per square foot. Typical properties of the clay were liquid limit 72 per cent., plastic limit 28 per cent., moisture content 31 per cent., and a dry density of 90 lb. per cubic foot. The conditions indicated the provision of friction piles. The preliminary design of the foundations therefore comprised twenty-two piles 10 in. square and 50 ft. long driven 30 ft. into the clay at a rake of 1 : 3. The greatest working loads for this arrangement would be 34 tons in compression and 18 tons in tension. Owing to the difficulties attending the use of a large piling frame, 12-in. diameter steel-cased piles driven in two lengths were eventually provided. These piles were driven by a 1¼-ton internal drop-hammer using false leaders mounted on a simple raking frame (*Fig.* 5). Driving proved to be harder than expected. After penetrating the top layers of clay, the piles were extended and redriven with a fresh plug, but soon met stiff resistance which steadily increased so that over two hundred blows per foot of penetration with a 6-ft. drop were required for the last 10 ft. At this rate of driving, the second concrete plug hardened before the required depth was reached and a third plug was generally required.

Loading tests were made on two vertical piles in the first group (*Fig.* 6). Each pile was first tested in tension by means of 100-ton jack and a steel beam, the pile

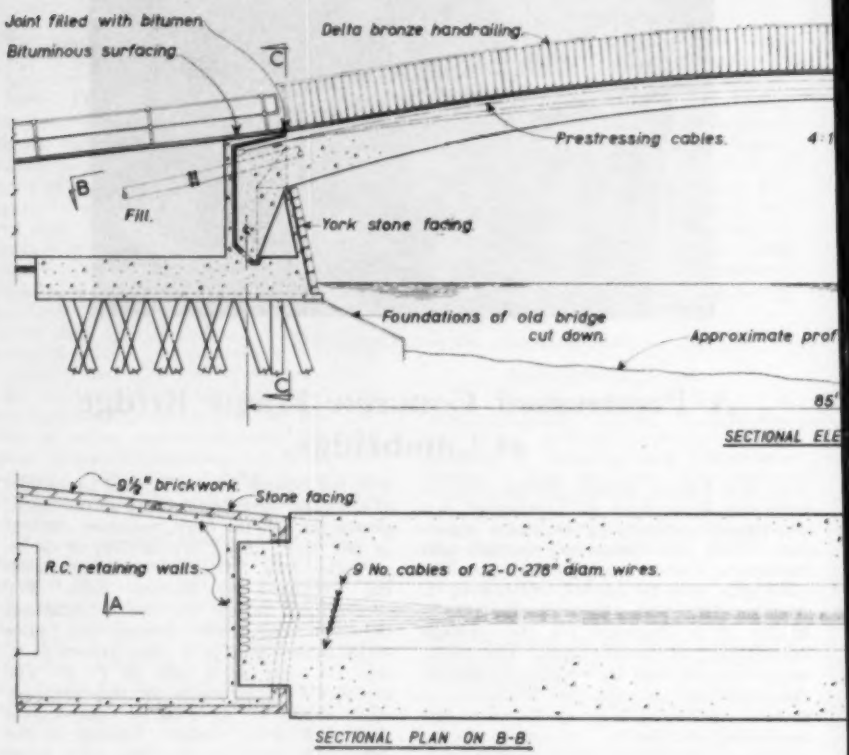
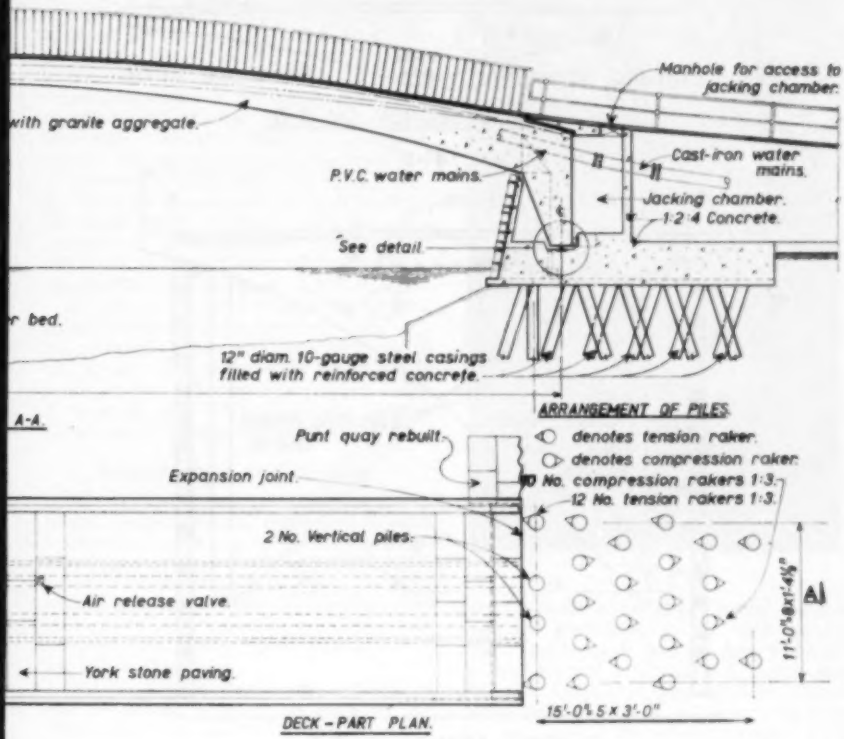

Joint filled with bitumen.
Bituminous surfacing.
Delta bronze handrailing.
Prestressing cables.
Fill.
York stone facing.
Foundations of old bridge cut down.
Approximate prof
85'
SECTIONAL ELE
9½" brickwork.
Stone facing.
R.C. retaining walls.
9 No. cables of 12-0·276" diam. wires.
SECTIONAL PLAN ON B-B.

Fig. 3.



being tied to the beam while the jack, resting on the other pile, levered up the first. A pull of about 19 tons was required to start each pile moving but only about 13 tons was needed to keep it moving. Allowing for the weight of the pile, these forces indicate an average adhesion between the pile and the clay of 0·12 ton per square foot. One of the piles was then tested in compression by maintaining a load of 50 tons on it for four days and then increasing the load to 65 tons for a shorter period. It was finally unloaded and reloaded for one day. There was little sign of settlement, since the recorded depressions of the head were hardly more than the elastic compression of the pile itself. The results showed that, contrary to the preliminary assumptions, the piles were mainly end-bearing with a comparatively small degree of friction. Some of the tension piles therefore had an inadequate factor of safety under the thrust due to the maximum live load so the addition of two extra tension piles at the back of each group was necessary. This addition also improved greatly the calculated balance and reduced the calculated tensile forces to within safe limits. A possible reason for the low frictional resistance and high end-bearing is that the consolidated clay under the toe of the pile, being unable to expand and take up water, behaved almost like rock, but that the clay around the pile, remoulded and wetted by the pile itself, was drastically weakened. In addition, the upheaval of the clay and

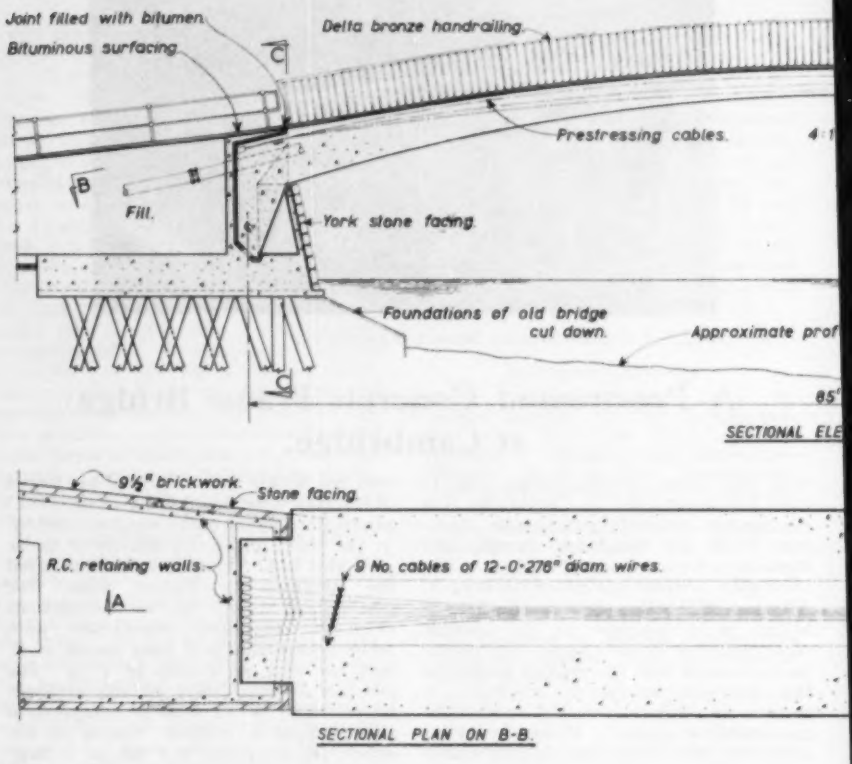
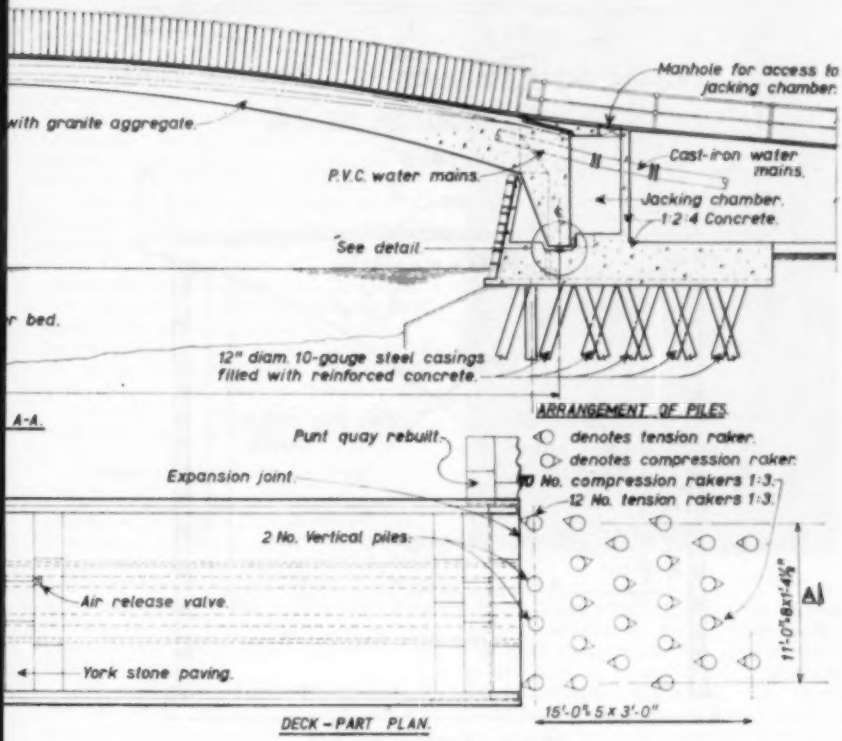

Joint filled with bitumen.
Bituminous surfacing.
Delta bronze handrailing.
C
Prestressing cables.
4:1
B
Fill.
York stone facing.
Foundations of old bridge cut down.
Approximate prof
C
85'
SECTIONAL ELE
9½" brickwork.
Stone facing.
R.C. retaining walls.
A
9 No. cables of 12-0·276" diam. wires.
SECTIONAL PLAN ON B-B.

Fig. 3.



being tied to the beam while the jack, resting on the other pile, levered up the first. A pull of about 19 tons was required to start each pile moving but only about 13 tons was needed to keep it moving. Allowing for the weight of the pile, these forces indicate an average adhesion between the pile and the clay of 0·12 ton per square foot. One of the piles was then tested in compression by maintaining a load of 50 tons on it for four days and then increasing the load to 65 tons for a shorter period. It was finally unloaded and reloaded for one day. There was little sign of settlement, since the recorded depressions of the head were hardly more than the elastic compression of the pile itself. The results showed that, contrary to the preliminary assumptions, the piles were mainly end-bearing with a comparatively small degree of friction. Some of the tension piles therefore had an inadequate factor of safety under the thrust due to the maximum live load so the addition of two extra tension piles at the back of each group was necessary. This addition also improved greatly the calculated balance and reduced the calculated tensile forces to within safe limits. A possible reason for the low frictional resistance and high end-bearing is that the consolidated clay under the toe of the pile, being unable to expand and take up water, behaved almost like rock, but that the clay around the pile, remoulded and wetted by the pile itself, was drastically weakened. In addition, the upheaval of the clay and

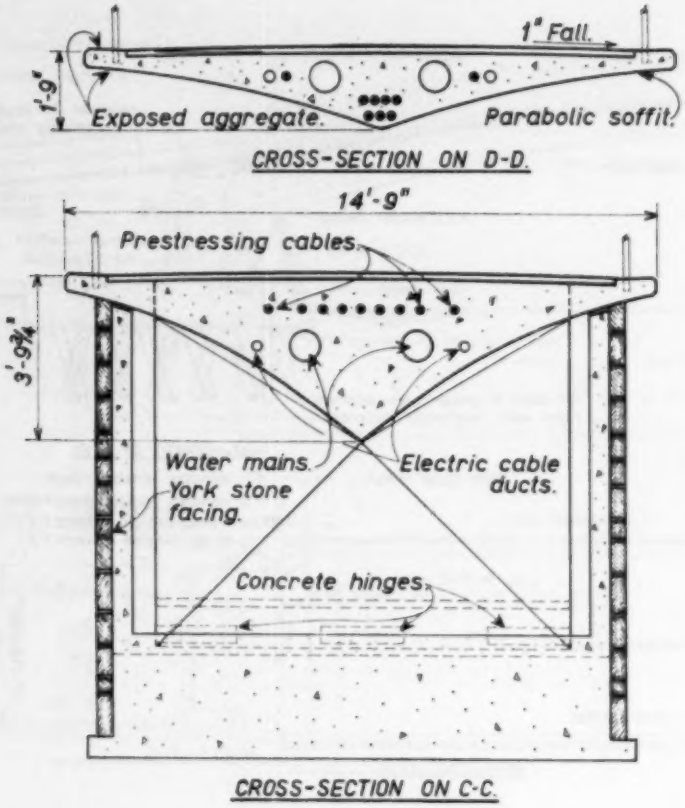


Fig. 4.

the vibration of the pile tended to leave a space around the pile after driving.

Superstructure.

Alternative schemes for supporting the frame were considered. Although the possibility of connecting the legs of the frame together by means of ties in the river bed was attractive, such ties, if horizontal, would require the provision of cofferdams, and if the ties followed the profile of the river bed an inverted arch would be required to hold them down. Both schemes had the disadvantage of being obstructed if any old foundations were encountered, and neither seemed likely to be cheaper than piling.

Because the stresses at the crown would be greatly affected by horizontal movement and small variations in the horizontal thrust, a two-hinged frame structure was adopted. A concrete hinge is provided at one end and at the other the support is on rollers (*Fig.* 8). The thrust was applied by jacking, as in this way the effects of shrinkage, elastic shortening and bending due to the prestress are practically eliminated and could therefore be omitted from the design calculations, and other uncertainties were minimised. Long-term settlement and creep could be compensated by additional jacking in the future and provision for jacks is accessible from the road for this purpose in a chamber at one end of the bridge (*Fig.* 9).

The natural frequency of vibration of

the bridge was investigated for various conditions of loading. Assuming fixed ends, the natural frequency of the transom is about 3½ to 4½ cycles per second, depending on the live load. This frequency is too high for the vibrations to be increased resonantly by pedestrians and therefore no special precautions were necessary. As the bridge is intended mainly for pedestrians it is designed for an imposed load of 100 lb. per square foot. To allow for occasional vehicular loading, the local effect of wheel loads was also considered, and although this did not affect the general design, it did influence the cantilevered slabs at each abutment.

A pair of 8-in. water mains suspended beneath the old bridge have been replaced by embedding two 8-in. P.V.C. pipes in the deck. The pipes were readily bent insitu to suit the curve of the structure. A pair of 3-in. steel ducts for electric cables are also embedded in the deck.

Prestressing and Jacking.

The transom, but not the legs of the frame, is prestressed. Nine cables, each comprising twelve 0·276-in. wires, with helical anchorages, are provided. No extra reinforcement is required for conditions at ultimate load. The cables were prestressed in three stages, and were grouted immediately after completion of the third stage.

The horizontal thrust was applied, at the calculated amount, as soon as the cables had been grouted. Special equipment was made for this structure because ordinary hydraulic jacks, with gauges connected to an oil system, may not have an accuracy of more than ± 7 per cent. By the special equipment, the thrust could be adjusted to ±¼ ton. Each of the two special jacks was operated by a separate hand-pump. The rams of the jacks were hollow and accommodated 100-ton load-cells designed to take 100-per cent. over-load. Readings were taken on a potentiometer indicator mounted on a frame and connected to the load-cells by cables. A switch enabled either or both load-cells to be connected to the indicator as desired.

Fig. 5.

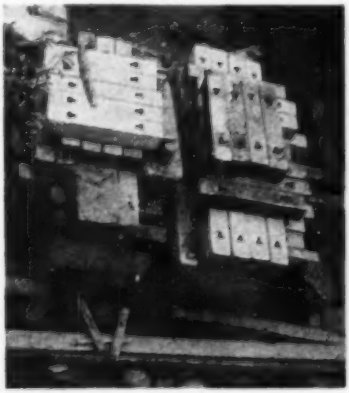


Fig. 6.

The theoretical effects of various loads and conditions are given in the following.

Load or Condition	Thrust at Hinge tons	Bending Moment at Crown tons-ft.
Dead load	+70·3	+77
Max. live load	+37·6	+45
±50 deg. F.	±3·1	±37
Tensioning of tendons	−9·0	−107
Shrinkage (5×10^{-4})	−5·2	−62
1-in. horizontal movement	±10·2	±122

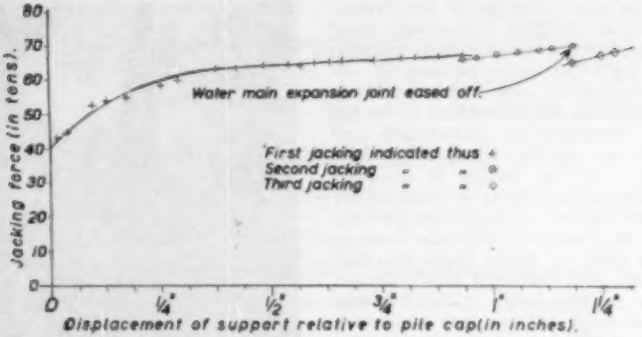


Fig. 7.

It was therefore necessary to jack one leg more than 1 in. inwards towards the other leg to compensate for the shortening due to prestressing and early shrinkage. The balance of about ¼ in. of movement, required to establish the calculated thrust, is attributed to the settlement of the pile-caps. The movement of the leg was measured relative to the pile-cap on which it rested.

The jacking operation was repeated six weeks after casting and again four months later. The results are shown in *Fig.* 7. By releasing the load on the jacks slightly and allowing the bridge to spring back by $\frac{1}{16}$ in., it was possible to measure the friction at the roller bearing. Several such measurements were made which gave values of from 4 to 6 per cent.

Construction.

A gantry (*Fig.* 3) on timber piles was erected alongside the old bridge and most of the work was carried out from this staging. The cast-iron bridge was cut up and removed and the concrete-filled masonry abutments were taken down. The foundations of the old bridge, which was built in 1837, were timber piles driven into the clay and capped with timber beams and covered by a timber mat. Some of the timbers, all in good condition, had to be extracted to make way for the new piles. A platform of steel beams supported on timber piles was erected to support the shuttering (*Fig.* 10). The complex double-parabolic curvature of the soffit prevented the use of a stiff shutter lining and narrow tongued-and-grooved boards were used as sheeting (*Fig.* 11). Two rubber strips were inserted transversely across the bridge to allow for shrinkage. Expansion joints are provided at each end of the bridge where the P.V.C. pipes connect to cast-iron pipes in the approaches (*Fig.* 9).

The concrete was supplied from a ready-mixed plant ten miles from the site. Aggregates from Cornwall were supplied direct to this plant. The deck of the bridge was concreted in one day. The concrete mixture was transported dry in

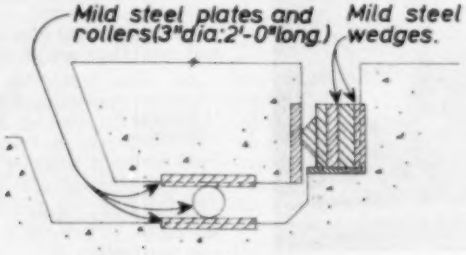


Fig. 8.

Fig. 9.

mobile mixers, water being added on arrival at site. Placing of the concrete was completed in nine hours. A view of the site during concreting is shown in *Fig.* 12. The surface of the concrete was kept moist for a week. The soffit shuttering was removed fifteen days after placing, when the third stage of the prestressing had been completed.

Finishes.

The architect required the concrete to be rough and sparkling, but not white, and Cornish de Lank granite aggregate, point tooled, was used. This granite is coarse-grained, white and grey, with some mica. High strength as well as good appearance was necessary, but it was disappointing that in the first trial mixtures a crushing strength of only 5000 lb. per square inch was obtained at twenty-eight days with an aggregate-cement ratio of 4 to 1, ordinary Thames Valley sand being used. When this sand was replaced by Cornish Pentewan sand, a coarse and well-rounded material, the crushing strength increased to 8000 lb. per square inch for an equally workable mixture ; the appearance was also greatly improved.

The aggregate was exposed on all visible surfaces of the bridge. Ordinary bush-hammer tools made no impression on the concrete but light rotary descaling pneumatic hammers were found to be suitable for down-hand work and probably the best that could be used for laborious over-hand work on the soffit. After

Fig. 10.

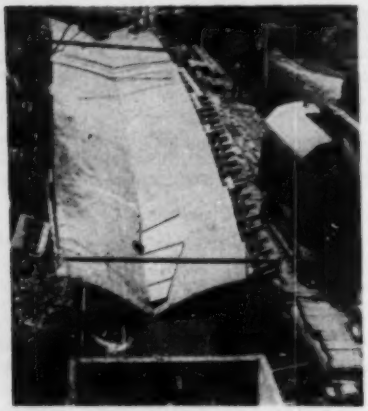


Fig. 11.

three passes with the descaling hammers, the lines of the shutter boards could still be seen by the slight changes in the colour of the concrete, but this feature was not unpleasant and was accepted by the architects. The abutments were treated to represent massive springings for the pseudo-arch by carrying the York stone facing on concrete screen walls around the legs of the frame. The deck appears to end directly above the apparent springings. The paving of the deck is carried on cantilevered slabs over the legs of the frame. The expansion joints provided between the bridge and the approaches allow 1½ in. of movement at the jacking end, but only the least space required for hinging freely at the other end. Where the old brick retaining walls had to be demolished, they were replaced by reinforced concrete faced with old hand-made bricks to match the original work. The new walls and the stone-faced screen walls around the legs are carried on the pile-caps and provide additional stability and prevent differential movement.

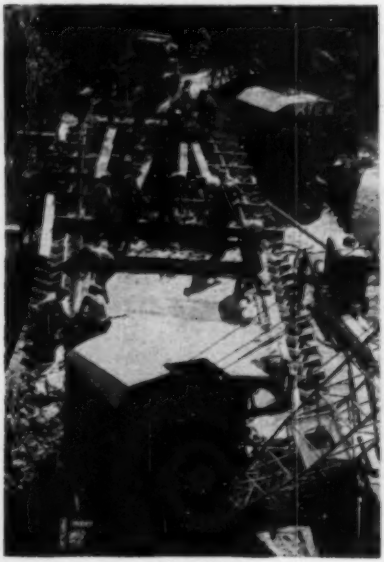


Fig. 12.

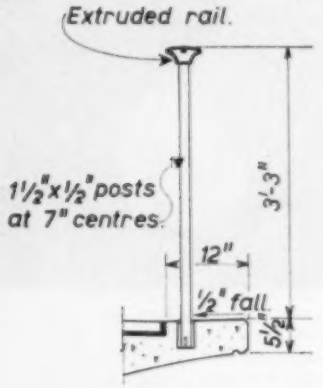


Fig. 13.

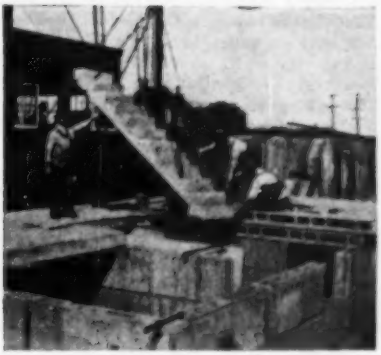
The bridge is provided with satin-polished Delta bronze handrails (*Fig.* 13), with slender posts set perpendicular to the footway. The paving is of York stone. A punt quay adjoining the bridge was widened and repaved.

The information for this article, which is published by permission of the Corporation of the City of Cambridge, was supplied by MR. T. V. BURROWS, A.M.I.C.E., City Engineer, and MR. M. J. BARCLAY, B.A., A.M.I.C.E. The bridge, the architects for which are Messrs. Guy Morgan & Partners, was designed by the main contractors, Messrs. J. L. Kier & Co. Ltd., and was constructed under the supervision of the City Engineer's Department. The piles were supplied and driven by British Steel Piling Ltd.

FIFTY YEARS AGO.

From "Concrete and Constructional Engineering", August, 1911.

Precast Concrete Houses.



The accompanying illustrations, which are self-explanatory, show a method of precast concrete construction applied to houses in the U.S.A. in 1911.

Stress Analysis Conference.

The Second International Conference on Stress Analysis is to be held in Paris in April, 1962. Details of the Conference are obtainable from Groupment pour l'avancement des Methods d'Analyse des Contraintes, 10 Rue Vauquelinc, Paris 5; or the Joint British Committee for Stress Analysis, 1 Birdcage Walk, London.

Multiple-storey Flats at Woolwich.

Floors of "Flat-plate" Construction.

THE St. Mary's redevelopment scheme at Woolwich is on a crescent-shaped island site of about six acres and includes two fourteen-storey and two thirteen-storey butterfly-shaped tower blocks of flats up to 138 ft. high (*Fig.* 1) and several buildings of lesser height. A preliminary description of the tall buildings is given in the number for January, 1961, a feature of the work being the rapid rate of construction.

The ground on the site comprises a stratum of sandy marl overlying clay. A railway tunnel runs under the southern corner of the site. The foundations of the multiple-storey blocks are 17-in. diameter bored piles each of which supports a load of 50 tons at an average depth of 30 ft. The frames of these blocks are of reinforced concrete (*Fig.* 3) with floors of "flat-plate" construction supported on rectangular columns. The arrangement of the columns is shown on the plan in *Fig.* 2. The exposed faces of the columns and edges of slabs are of fair-faced finish. The shuttering was lined with plywood. The infilling panels are of flint-lime bricks, and cavity walls of concrete blocks with insulation of aluminium foil in the cavity. The decorative precast concrete panel under each window contains a black

Fig. 1.

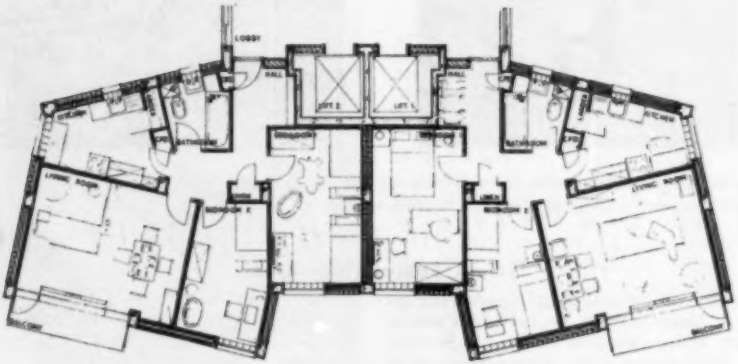
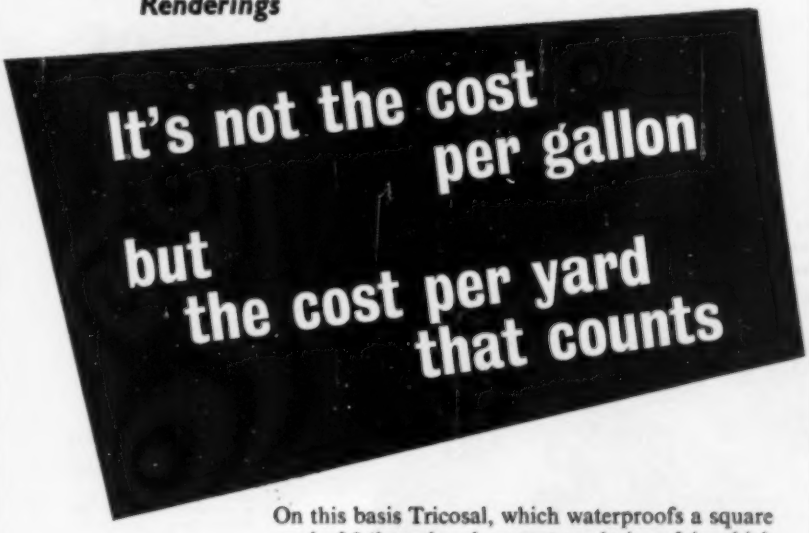


Fig. 2.—Plan of half block showing arrangement of columns.

The £.s.d of OSAL*

—Waterproofing Cement Renderings



On this basis Tricosal, which waterproofs a square yard of 3/1 sand and cement renderings ½ in. thick for only 3¼d., is the most economical as well as the most efficient additive. It waterproofs integrally and, being a liquid, mixes with the gauging fluid and is evenly distributed throughout the mix.

Now supplied in non-returnable containers

INTEGRAL CEMENT
TRICOSAL
HARDENER·PROOFER

For 30 years or more Tricosal has been specified by leading Architects not only for waterproofing but for hardening cement and concrete and increasing their resistance to oils and acids. Send for Information Leaflet No. 1.

* *Osal is the generic name for the products of A. A. BYRD & CO. LTD.—Florosal, Neocosal, Tricosal and Lubrosal. Literature about each individual product is available on request.*

A. A. BYRD & CO. LTD. (Dept C9) 210 TERMINAL HOUSE, GROSVENOR GARDENS, LONDON, S.W.1

Phone: SLOane 5236 Grams: Byrdicom, Wesphone, London · Works: Basingstoke, Hants

for the design and supply of

PRESTRESSING BEDS and EQUIPMENT

you-too-can rely on

STELMO

who offer a unique service in providing the most economical layout for your works or on the site for the production of pre-tensioned concrete. It includes the design and supply of prestressing beds, tipulds, wire-handling equipment, jacks, anchorages, etc.,— all specially designed to suit your conditions.

One of a batch of Stelmo prestressing beds supplied to Richard Costain Ltd.

STELMO *the most comprehensive mould service in the world*

STELMO LTD · WESTWELL LEACON · CHARING · ASHFORD · KENT. *Tel: Charing 395-7*

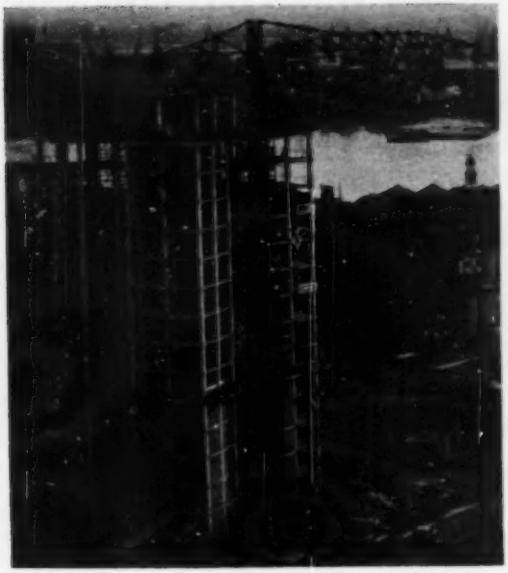


Fig. 3.

pigment. The floors and roofs of the balconies are of concrete. At the entrance to each block there is a concrete canopy with a painted soffit and mosaic fascia. Concrete tiles are provided on the ground floor of the entrances, but the ground floors are of granolithic construction elsewhere. The inner ledge of window sills are of concrete tiles.

Some maisonettes on the same site are of cross-wall construction, supported on a reinforced concrete raft, with brick and precast concrete wall panels. Floors, stairs and balconies are of reinforced concrete and the sloping roofs are covered with concrete tiles.

Tower cranes were used in the construction of the tall blocks with the exception of the first to be constructed, in which case a climbing crane was used. The average rate of construction of the structural frame of the multiple-storey block was about 4½ working days per storey.

The buildings are erected for the Woolwich Borough Council, the architects and engineer being Messrs. Norman and Dawbarn. The contractors are Messrs. Wates Ltd. The precast concrete panels under the windows and the precast tiles for the sills were made by Wadcrete Ltd. The site investigation was made by Soil Mechanics Ltd., and the piling was installed by Pressure Piling Co. (Parent) Ltd. The roof tiles were provided by Messrs. A. H. Herbert & Co. Ltd.

Institution of Structural Engineers.

MR. F. R. BULLEN, B.Sc.(Eng.), M.I.C.E., has been elected President of the Institution of Structural Engineers 1961–62. The Gold Medal of the Institution has been awarded to MR. FELIX CANDELA, the eminent Mexican architect-engineer.

Handbooks Received.

"**BRC Reinforcements.**" Thirteenth Edition. 1959. (Stafford: British Reinforced Concrete Engineering Co. Ltd.)

"**The National Federation of Plastering Contractors Year Book.**" [Watford: Coram (Publishers) Ltd. Price 5*s.*; or in cloth 7*s.* 6*d.*]

A Motorway in Italy.

WHAT is probably the largest project for a motorway in Europe is the Autostrada del Sole which will connect Milan with Naples, a distance of 450 miles. The motorway will pass near Modena, Bologna, Florence and Rome, and in its course it will cross the Apennines. The work will include thirty-five large prestressed and reinforced concrete bridges in addition to twelve reinforced concrete arch bridges, one of which is shown in the accompanying illustration. There will be forty-seven tunnels.

The work is being carried out by a private concern, the Società Concessioni e Costruzioni Autostrade, the Director-General of which, Dr. Ing. Sergio De Amicis, gave a lecture in London in June in which the design and construction of many of the bridges were described. The section from Milan to Bologna was opened in 1959 and includes a prestressed concrete bridge and viaduct having a total length of 3860 ft. over the River Po near Piacenza. The bridges are designed by various Italian engineers so that there are a variety of designs and types. Bridges of spans less than 33 ft. were designed by the Società.

The three most common methods of prestressing being adopted are the B.B.R.V. system (Swiss), Freyssinet system (French), and Morandi system (Italian).

Publications by the Cement & Concrete Association.

THE following publications, which have been issued recently by the Cement & Concrete Association, are available free of charge from the Association at 52, Grosvenor Gardens, London, S.W.1.

"Tests on a One-sixth Scale Model of a Hyperbolic Paraboloid Umbrella Shell Roof." By L. L. Jones.

"Tests on Prestressed Concrete Poles." By R. Buhrer.

"An Investigation of the Use of Strand in Pre-tensioned Prestressed Concrete Beams." By G. D. Base.

"Standard Beam Sections for Prestressed Concrete Bridges."—An abstract from the preliminary publication on standard prestressed concrete beams given in this journal for May, 1961.

"The Dynamic Behaviour of Prestressed Bridges." By A. Rosli.

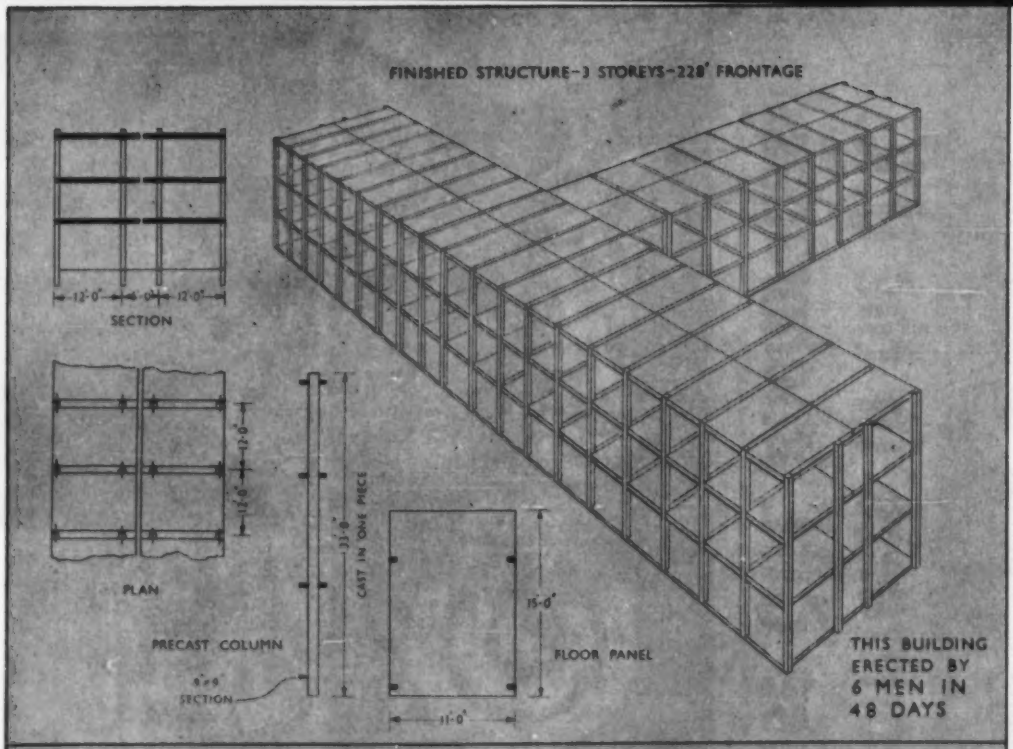
"Lean Concrete and Cement Bound Granular Base Material."

"Why Concrete for the Roads of Tomorrow?"

"Prestressed Concrete Roads: Tests and Future Prospects." By R. Peltier. (Translation No. 91.)

"Structural Concrete—Office Blocks."

"An Investigation of the Behaviour of Composite Concrete Beams—Composite Rectangular Beams." By S. Kajfasz and R. E. Rowe.



Modular concrete

THE MODULAR CONCRETE COMPANY LIMITED
Construction Division, 1260 London Road, Norbury S.W.16
TELEPHONE: POLLARDS 5080

The structure illustrated indicates just one of the services offered by the Modular Concrete Co. Ltd. A prefabricated building on a 12′ × 12′ column grid with a 6′ corridor between. Plan form and height variable.

It consists of TWO components:—

33′ columns cast in one length
15′ × 11′ floor slabs with integrated perimeter beams.

Columns contain fabricated steel shear connectors on to which the floor slabs seat directly without propping. The method makes for extremely quick and safe erection procedure and eliminates hazards often associated with connection of precast elements.

All services can be catered for quite simply.

Speed and economy result from SIMPLICITY AND REPETITION—attained by this example of OPTIMUM PREFABRICATION.

Write or 'phone Modular for further details.

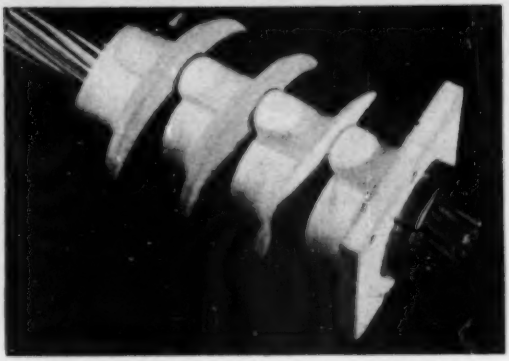
FOUR OUT OF FIVE LARGE

Strand

contracts in the U.K. use CCL anchorages

CCL $1\frac{1}{8}$" Spiral anchorages

CCL Spiral Anchorages are used extensively, both at home and overseas, due to their advanced design and reliability under site conditions. These all-metal, embedded type anchorages provide additional safety against bad concrete compaction.



For helpful advice or technical information write to:

CABLE COVERS LIMITED · *St Stephen's House* · *(Technical Service Dept)* · *Westminster S.W.1*

Training of Operatives and Foremen.

THE following comments have been received regarding the Editorial Note in the May number entitled " Training of Operatives and Foremen ".

" I endorse the view stated that ' foremen require specific training, since a foreman is a link between the workmen and management '.

The position of junior managers and supervisors in the changing situation in industry today makes this training a necessity. Managers are today confronted by a major shift in the social foundations of industry and commerce, which has been brought about by full employment, the higher economic status of the worker, the narrowing differences between the unskilled, semiskilled and skilled worker, the increased importance of the Trades Unions, and the rapid increase of specialist departments in industry.

Up until the 1930's, the management of workmen was comparatively simple, because the manager could work on the assumption that people under him would understand what they were told and, more important, do what they were told. Nowadays, organisation is more complicated and the old conditions of unquestioned authority no longer hold. Even the combination of native wit and experience of ' the born manager ' cannot grasp a situation constantly altering and resulting in new problems, many of which fall into one of two categories. Firstly, there are the problems of the supervisor or foreman, who since the War seems to have lost much of his pre-war authority, as his superiors tend to deal direct with Trades Unions at the workers level and in the consultative process, he may not even be represented. Often he is paid less than the men working under him.

An obligation of managers is to reinstate the foreman as an essential link in the system of management, and this constitutes the second group of problems, namely those dealing with the organisation of the many new and varied functions in industry of the people fulfilling these functions. The man in authority requires a framework of ideas which will enable him, whatever his position and rank, to know where he stands and what his relationship with his collaborators should be. The pattern of relationship governs the communications with his colleagues and his subordinates. What is required is more fundamental and critical thinking. The problems are greater in the constructional and civil engineering field because of the very nature of the work, with employees spread out over many different sites, and where a comparatively junior member of the management has to deal with many and varied problems totally unsupervised or with very little supervision.

To meet this need and to deal with the problems of management peculiar to each firm, private organisations have for some years presented courses to suit the needs of individual firms and of different levels of management and supervision. I agree that there is a growing need for training of this kind to be carried out, and you mentioned the work done by the Industrial Welfare Society, which with other organisations like the British Institute of Management and the Institute of Industrial Supervisors, to mention only two, already provide facilities for organised training. I do not agree that there is a case for a new institute being established to provide what can already be obtained from the established organisations. What I think is necessary is that top management in an industry must examine their own particular problems and needs, and since these vary considerably from industry to industry and indeed from firm to firm, I suggest that the problem can best be dealt with by firms taking a more active interest in their own management structure and training. My experience is that many firms have found that their own efforts, helped by a private organisation, together with the work done by the professional organisations, is the most effective method."—G. SIMPSON.

Reinforcement in Great Britain.

IT is reported by the Reinforced Concrete Association that in 1959 the consumption of reinforcement in Great Britain was 450,000 tons and 600,000 in 1960. It is estimated that the requirements in 1965 will be 800,000 tons.

Symposium on Shell Research.

THE principal papers which are intended to be read at the Symposium on Shell Research to be held at Delft, August 30 to September 2, 1961, are as follows.

"Some Tests on Four Types of Hyperboloid Shells", by R. E. Rowe (Great Britain).

"Static and Dynamic Loadings on Hyperbolic Paraboloids and Folded Plates", by P. J. Brennan (U.S.A.).

"Static Tests on Hyperboloidical Shell Models", by E. Lauletta (Italy).

"An Investigation of the Strain Distribution in Reinforced Concrete Shallow Thin Shells of Negative Gaussian Curvature", by J. Munro and B. M. Ahuja (Great Britain).

"Investigation of Models of Cylindrical Shells of Reinforced and Prestressed Concrete", by A. L. Bouma (Netherlands).

"Analysis, Design and Construction of a New Shell of Double Curvature", by G. S. Ramaswamy (India).

"Die Verwendung von Gipsmodellen für experimentelle Untersuchungen von Doppelt-gekrümmten Wellenschalen und Kegelstumpfschalen und die Ergebnisse", by H. Rühle (D.D.R.).

"Lattice Work Rotation Shells (Domes) and Orthotropic Cylindrical Steel Shells", by F. Lederer and V. Horak (Czechoslovakia).

"Ergebnisse von Beulversuche mit Doppelt-gekrümmten Schalenmodellen aus Aluminium", by H. Schmidt (D.D.R.).

"Zylinderschalen unter Unstetigen Belastungen, Spannungsoptische Untersuchungen", by G. Franz (West Germany).

"Aerodynamic Forces on and Photoelasticity of the Stresses in Hyperbolic Paraboloid Roofs", by P. B. Morice, L. G. Booth and H. Tottenham (Great Britain).

"La Théorie Exacte de la Méthode Moiré", by K. Szmodits (Hungary).

"Experimental Foundation of the Limit Analysis of Reinforced Concrete Shells", by W. Olszak and A. Sawczuk (Poland).

"Configuration of Shell Structures for Optimum Stresses", by H. P. Harrenstein (U.S.A.).

"A Contribution to the Practical Design of Cylindrical Shells", by S. Lapajne (Yugoslavia).

"Experimental Methods as a Help in the Design of Shell Structures in Poland", by W. Zalewski (Poland).

Federation of Civil Engineering Contractors.

IN the Annual Report of the Federation of Civil Engineering Contractors for the year 1960–61 it is stated that the demand for more work by members of the Federation remains unsatisfied in spite of a continued increase in the volume of constructional work during a year when economic activity generally was restricted. The Government's acceleration of the road programme is welcomed but there is much more to be done in developing schemes for water supply, sewerage and flood prevention. The increase in authorisations for water and sewage schemes was, however, continued during 1960. There was a considerable increase in new work for private developers other than housing, but the amount of work for public authorities decreased.

Over 80 per cent. of the funds for the Civil Engineering Scholarship Trust, which was inaugurated in May, 1958, and is sponsored by the Institution of Civil Engineers, the Association of Consulting Engineers and the Federation, was contributed by members of the Federation. During the year, the Federation commenced investigation of the possibilities of developing training within the civil engineering contracting industry, including the establishment of a three-year scheme for training technical assistants, who, though not possessing the ability to qualify as engineers, could carry out supervisory work on conventional civil engineering contracts.

At March 31, 1960, sixty British firms were working overseas, a third of the business being in Africa and a quarter in Canada. The value of export business in the year was about £130,000,000.

Reinforced Concrete Association.

THE principal officers of the Reinforced Concrete Association elected for the current year are President, Mr. A. P. Mason, B.Sc., M.I.C.E. (British Reinforced Concrete Engineering Co., Ltd.), and Vice-President, Mr. D. P. Harris (Terresearch Ltd.).

This bag contains more than Pozzolith

POZZOLITH + TECHNICAL SERVICE

Why do we provide technical help? Technical products, such as POZZOLITH, for improving the quality of concrete, are complex chemical compounds with a wide range of benefits. Achieved only by the appropriate adaptation of the product. Maximum benefit from these modern materials for improving concrete can be obtained only through:

1. Selection of the proper product to meet most effectively and most economically job requirements and local conditions.
2. Proper use of the product at the job site.

Competent field service results in the effective use of Pozzolith under varying site conditions

Write for further details to

Manufactured and distributed in Great Britain by MILLARS' MACHINERY COMPANY LIMITED, Pioneers Hall, Great Winchester Street, London, E.C.2. Tel: London Wall 4288

POZZOLITH

Millars

Under licence from THE MASTER BUILDERS' CO. A division of American Marietta Company.

elevenses...

. . . and

FONDU CONCRETE

placed yesterday is ready for anything

Eleven o'clock—time for the traditional break and reminder that the FONDU concrete laid yesterday morning has reached full strength.
Unapproachable speed of maturing is only one of the advantages of FONDU concrete. It also has the unique merit that the concrete is permanent under conditions which destroy ordinary concrete. Many industrial chemicals do not harm Fondu concrete, so that it is the safe solution to much constructional and repair work in many industries. Also, using firebrick aggregate, CIMENT FONDU provides an adaptable refractory concrete for temperatures up to 1350° C. CIMENT FONDU can save you time and money on your contract work by eliminating waiting time and keeping the concrete section always one step ahead of the others.
Let us send you our 32-page Booklet " THE CEMENT FOR INDUSTRY ".

The Cement for Industry

FOR SPEED · STRENGTH · RESISTANCE · REFRACTORINESS

LAFARGE ALUMINOUS CEMENT CO. LTD.

73 Brook Street, London, W.1.
Telephone: MAYfair 8546

CIMENT FONDU
Royal Trade Mark
ALUMINOUS CEMENT

A Record Supply of Ready-mixed Concrete.

In this journal for July last, an account was given of the supply of 1185 cu. yd. of ready-mixed concrete in twelve hours in connection with the foundations of the new Hilton hotel, London. The accompanying illustration shows the arrangement of the delivery equipment. The concrete was discharged through metal trunking and was carried on belt-conveyors to various parts of the site.

DATA FOR PRICING REINFORCED CONCRETE.

MATERIALS (*Delivered London*).

AGGREGATES (per cu. yd.).
Washed sand: 26*s.* 9*d.* Graded gravel (¾ in.): 24*s.* 3*d.* Pit ballast: 25*s.* 6*d.*

CEMENT (per ton).
Ordinary Portland.—8 tons and upwards: 115*s.* 3*d.*
Rapid-hardening Portland: As ordinary Portland plus 10*s.* 6*d.* "Aquacrete" and "417": As ordinary Portland plus 32*s.* 6*d.* "Colorcrete" (buff, red, and khaki): As ordinary Portland plus 60*s.* "Snowcrete" (white): 280*s.* 9*d.*
"Super-Cement": As ordinary Portland plus 32*s.* 6*d.*
High-alumina cement.—6 tons: 314*s.* 6*d.*
"Super Snowcem" waterproof cement paint: 100*s.* per cwt.

REINFORCEMENT (per ton ex stock including delivery in quantities from 10 to 500 tons).
Plain mild steel rods per B.S. No. 785.—1 in. and over: £50 5*s.*; ⅞ in. and ¾ in.: £51; ⅝ in.: £51 15*s.*; ½ in.: £53 7*s.* 6*d.*; ⅜ in.: £54 17*s.* 6*d.*; ¼ in.: £58 17*s.* 6*d.*
Hot-rolled deformed bars: As plain bars plus £1.
High-tensile (minimum yield point 44,000 lb. per sq. in.): As mild steel plus 19*s.*
(For basic prices and allowances for quantities exceeding 500 tons and extras for quantities less than 10 tons, lengths greater than 40 ft. or less than 5 ft., bundling, labelling, and delivery in other areas, see "Concrete Year Book, 1961".)
Fabric per B.S. 1221A (per sq. yd.).—No. 109: 3*s.* ½*d.*; No. 121: 5*s.* 7½*d.*; No. 124: 3*s.* 4½*d.*; No. 125: 2*s.* 10*d.*; No. 126: 2*s.* 6½*d.*

TIMBER.—Sawn deal shutter boards: £95 to £100 per standard (165 cu. ft.); 1-in. boards: 1*s.* (av.) per sq. ft.; 1½-in. boards: 1*s.* 3½*d.* (av.) per sq. ft.

MATERIALS AND LABOUR.

Based on net cost of materials plus 10 per cent. and net cost of labour plus 45 per cent. for insurances, etc. (10 per cent.), on-costs (22 per cent.) and profit (10 per cent. on gross cost = 13 per cent. on net cost). No allowance for non-productive ordinary time, overtime, travelling time, fares, subsistence, etc. Wages (per hour).—Carpenters and joiners: 5*s.* 1½*d.*; labourers: 4*s.* 6*d.*; mixer and hoist operators: 5*s.*; bar benders: 4*s.* 11½*d.*

PORTLAND CEMENT CONCRETE (1 : 2 : 4).
Foundations (per cu. ft.).—3*s.* 6*d.*
Suspended slabs (per sq. yd.).—6 in., 18*s.* 3*d.*; 7 in., 21*s.* 4*d.*; 9 in., 27*s.* 5*d.*
Beams (per cu. ft.).—4*s.* 1*d.* Columns (per cu. ft.).—4*s.* 7*d.*
Walls (per sq. yd.).—6 in., 19*s.* 11*d.*; 9 in., 29*s.* 10*d.*;
12 in. and over (per cu. ft.), 3*s.* 7*d.*
Extra (per cu. yd.) for rapid-hardening Portland cement. 1 : 2 : 4.—2*s.* 8*d.*

REINFORCEMENT.—Mild steel rods cut, bent and fixed (per cwt.).

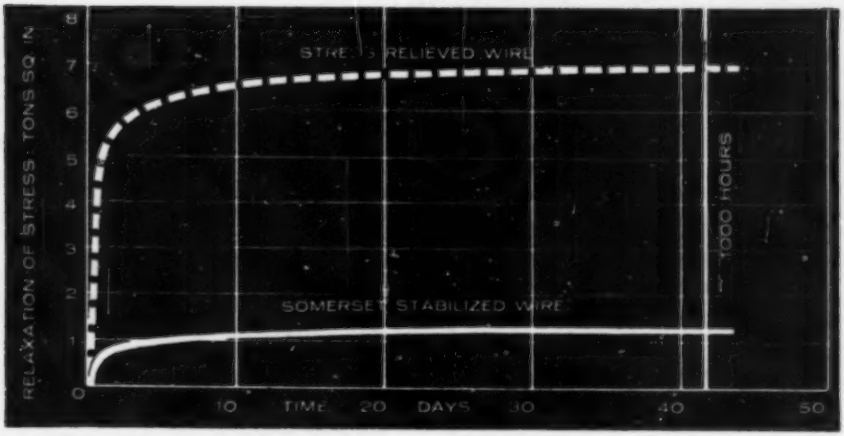
	In floor slabs and beams.	In columns.	In walls.	Stirrups, binders, etc.
1 in. and over	75*s.* 6*d.*	81*s.* 2*d.*	78*s.* 10*d.*	—
⅞ in. and ¾ in.	76*s.* 3*d.*	81*s.* 11*d.*	79*s.* 7*d.*	—
⅝ in.	77*s.* 1*d.*	82*s.* 9*d.*	80*s.* 5*d.*	—
½ in.	84*s.* 7*d.*	91*s.* 5*d.*	89*s.* 2*d.*	—
⅜ in.	86*s.* 3*d.*	93*s.* 1*d.*	90*s.* 10*d.*	103*s.* 4*d.*
5/16 in.	88*s.* 6*d.*	95*s.* 3*d.*	93*s.* 0*d.*	105*s.* 6*d.*
¼ in.	89*s.* 7*d.*	96*s.* 4*d.*	94*s.* 1*d.*	106*s.* 7*d.*

Fabric per B.S. No. 1221A in flat areas (per sq. yd.) including straight cutting.—No. 109: 4*s.* 5*d.*; No. 121: 8*s.*; No. 124: 4*s.* 9½*d.*; No. 125: 4*s.* 2½*d.*; No. 126: 3*s.* 7½*d.*

SHUTTERING (FORMWORK).—Assuming five uses of wooden shutters for floor soffits and walls, and three uses for beams.
Soffits of floors, flat roofs, etc. (per sq. yd.): 16*s.* 3*d.*; ditto sloping: 18*s.* 1*d.*
Walls and partitions (per sq. yd.): 19*s.* 11*d.*; ditto curved: 26*s.* 10*d.*
Rectangular beams, lintels, columns, etc. (per sq. ft.): 2*s.* 8*d.*; ditto circular: 3*s.* 8*d.*

This page is prepared specially for "Concrete and Constructional Engineering" and is strictly copyright.

You get the lowest relaxation using SOMERSET STABILIZED Prestressing Wire



COMPARATIVE RELAXATION GRAPH Initial Stress 80 tons/sq. in.
(Drawn wire in the stress relieved and stabilized condition)

★ Somerset Wire complies with B.S. 2691

★ Is available in plain, indented or helically crimped forms

★ Has stable elastic characteristics

STABILIZED by a patented 'Somerset' process

SOMERSET WIRE COMPANY LIMITED

Pengam Moors, Cardiff (Cardiff 37485)
Bridgwater, Somerset (Bridgwater 3001)

MISCELLANEOUS ADVERTISEMENTS.

Situations Wanted, 3d. a word: minimum, 12s. Situations Vacant, 6d. a word: minimum, 15s. Other miscellaneous advertisements, 6d. a word: minimum, 15s. Displayed advertisements, 40s. per column inch. Box number 1s. extra.

Advertisements must reach this office, 14 Dartmouth Street, London, S.W.1, by the 26th of the month preceding publication.

SITUATIONS VACANT.

SITUATIONS VACANT. Reinforced concrete and structural steelwork designers and detailers required at Bristol head office and in the London office. Permanent positions covering most fields of reinforced concrete and steelwork design. Pension and insurance schemes. Attractive salaries. Full details to NORRIS CONSULTANTS LTD., Beacon House, Queen's Road, Clifton, Bristol, 8.

SITUATIONS VACANT. Consulting engineers have vacancies for the following: Reinforced concrete designers with A.M.I.Struct.E.; Designer-detailers with H.N.C. or similar; Detailers with minimum two years' experience. The positions are permanent, with opportunity for advancement. Modern office and pleasant conditions. Salaries in accordance with experience. Apply BYLANDER, WADDELL & PARTNERS, 169 Wembley Park Drive, Wembley, or 10 Carver Street, Sheffield.

SITUATIONS VACANT. Reinforced concrete designer-detailers and detailers required by LEONARD & GRANT in their South London and Edinburgh offices. Applicants should have three years' minimum experience in position applied for. Good salaries and prospects, luncheon vouchers, etc. Interview by appointment. Telephone: London, MACaulay 6477; Edinburgh, CAL 3807

TAYLOR WOODROW CONSTRUCTION LIMITED

require

DESIGNERS: with experience in design and efficient detailing of large reinforced concrete and/or steel structures. There are opportunities for senior design appointments.

DETAILERS: capable of quick and accurate reinforcement detailing and some design under supervision.

DRAUGHTSMEN: must be neat and accurate workers with experience of reinforced concrete or structural steel outline and detail work.

These vacancies occur at the Head Offices in Southall.

Applicants should either telephone WAX 2366 (Mr. E. A. Woolnough—Atomic Power Design) (Mr. R. H. Walpole—General Industrial Design) or write to the

Personnel Manager, 345, Ruislip Road, Southall, Middlesex.

Alternatively, senior personnel will be available for informal discussions about these posts at our offices at 10 Park Street, W.1, from 5.30 p.m. each Thursday until 17th August inclusive.

SITUATIONS VACANT. Reinforced concrete engineers require experienced section-leaders and detail/draughtsmen. Interesting work, five-days' week, luncheon vouchers, own pension scheme, etc. Salaries in accordance with experience. Apply in writing to THE REINFORCED CONCRETE STEEL CO. LTD., 54 Victoria Street, Westminster, S.W.1.

SITUATIONS VACANT. Designer-detailers with minimum of three years' experience in reinforced concrete required in our London and Guildford offices. Salary according to qualifications and experience. Pension scheme. Write or telephone for appointment, either Balham 2486 or Guildford 2483. TERECON INDUSTRIAL DESIGN ENGINEERS, 11a Station Parade, Balham High Road, London, S.W.12.

SITUATIONS VACANT. Reinforced concrete designers and detailers very urgently required, Bristol/Bath. Excellent terms and conditions. Telephone: KEYNSHAM 3621.

QUALIFIED OR POST-GRADUATE ENGINEERS

required to work on the design of Precast Concrete Frame Structures, including Multi-Storey Flats.

Salaries range from £850 to £1,150 per annum, according to age and experience. Prospects of promotion, permanent position, Staff Pension Fund and Profit-sharing Scheme, five-days' week.

Apply: CONCRETE (NORTHERN) LTD. Stourton Leeds, 10.

Join the BRC team of

EXPERIENCED REINFORCED CONCRETE DESIGNER/DETAILERS and DRAUGHTSMEN

at any of the Design Offices at

STAFFORD	LEEDS
LONDON	LIVERPOOL
BIRMINGHAM	MANCHESTER
BRISTOL	NEWCASTLE
CHELMSFORD	GLASGOW
DUBLIN	

Apply

Chief Engineer:
A. P. Mason, B.Sc., M.I.C.E., M.I. Struct. E., M.ASCE
THE BRITISH REINFORCED CONCRETE ENGINEERING CO. LTD., STAFFORD

SITUATIONS VACANT. Harrow reinforced concrete engineers and contractors require experienced detailing-draughtsmen. Five-days' week; interesting work; modern offices; pension scheme after qualifying period. Write BERRUMS, 167–173 Imperial Drive, Harrow, or telephone for appointment Field End 7701.

SITUATION VACANT. Detailer-draughtsman required for detailing of precast concrete frameworks. Write, stating age and experience, to A. & C. BARVIS LTD., Manor Works, Church Road, Thundersley, Essex.

STRUCTURAL ENGINEER

EXCEPTIONAL OPPORTUNITY

Consulting Civil Engineers, Westminster, require a fully qualified structural engineer with wide experience for position as chief designer in reinforced and prestressed concrete and structural steelwork, including bridges and buildings.

Prospects of partnership interest in firm.

Write in confidence, stating age and full details of experience and qualifications, to BOX 4766, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.

SITUATIONS VACANT. Reinforced concrete designer-draughtsmen and experienced detailers required. Excellent working conditions in new building. Five-days' week. Luncheon vouchers. Realistic salaries paid according to age and experience. Write, giving full particulars, or telephone for appointment, to MR. A. A. LONG, HELICAL BAR & ENGINEERING CO. LTD., Eastbury House, 30–34 Albert Embankment, London, S.E.1. RELiance 9123.

SITUATIONS VACANT. Designer-detailers required for reinforced concrete work, with at least five years' experience. Able to work on own initiative. Good salaries for first-class men; luncheon vouchers; bonus scheme. Holiday arrangements honoured. Write: HUSBAND & CO., Consulting Engineers, 58 Victoria Street, London, S.W.1.

SITUATIONS VACANT. G.K.N. Reinforcements Ltd. have vacancies for experienced reinforced concrete designers and detailers in their offices in London, Birmingham, Glasgow, Southampton and Middlesbrough, and also for their newly-opened office at Wigan. Apply in writing to Chief Engineer, G.K.N. REINFORCEMENTS LTD., G.K.N. House, 22 Kingsway, London, W.C.2.

BRITISH RAILWAYS
(WESTERN REGION)

require

A technical assistant with experience in preparation of estimates and contracts for steelwork and reinforced concrete bridges, structures, etc. Salary range £945–£1,020.

Interesting work in pleasant conditions with promotion on MERIT.

Superannuation Fund.

Reduced rates of travel and other concessions.

Five-days' week.

Applications, giving age, qualifications and experience, to:—

CHIEF CIVIL ENGINEER
BRITISH RAILWAYS
WESTERN REGION
PADDINGTON STATION,
LONDON, W.2.

MIDDLESEX COUNTY COUNCIL
COUNTY ARCHITECT'S DEPARTMENT

Applications invited for the following appointments:

(a) STRUCTURAL ENGINEERS APT. IV (£1,185–£1,355 inclusive). Must be qualified and have had considerable experience in designing and detailing reinforced concrete and of design of structural steelwork.

(b) STRUCTURAL ENGINEERING ASSISTANTS APT. III (£1,005–£1,185 inclusive). Must be good draughtsmen with experience in detailing reinforced concrete and good knowledge of design. Structural steelwork experience an advantage.

(c) STRUCTURAL ENGINEERING ASSISTANTS APT. II (£815–£960) plus London Weighting up to £40. Must have good general knowledge of structural engineering and be neat and expeditious draughtsmen. Excellent opportunities for design experience.

Posts (b) and (c) require Graduate Membership of the Institution of Structural Engineers or similar qualification. All posts: Established. Pensionable. Prescribed conditions. Application forms from COUNTY ARCHITECT, 1 Queen Anne's Gate Buildings, Dartmouth Street, London, S.W.1, returnable immediately (Quote G.817/C & CE.)

Modular concrete

ASSISTANT WORKS MANAGER

required for

manufacture of high-grade precast concrete products. Engineer training preferred, experience of modern production methods, works costing and accounting.

Permanent and pensionable position.

Write, stating age, experience and salary required, to:

Managing Director,
MODULAR CONCRETE COMPANY,
1260 London Road, Norbury,
London, S.W.16.

FIRST-CLASS REINFORCED CONCRETE DETAILERS AND CIVIL ENGINEERING DRAUGHTSMEN

required by Consulting Engineers for wide range of work. Excellent salaries and prospects. Holiday arrangements honoured.

Write, stating age and full details of experience, to

HARRY BROMPTON & PARTNERS,
7–8 Hobart Place,
Grosvenor Gardens,
London, S.W.1.

LONDON COUNTY COUNCIL

BRIXTON SCHOOL OF BUILDING

Ferndale Road, London, S.W.4

require, as soon as possible

ASSISTANT GRADE B to teach CIVIL AND STRUCTURAL ENGINEERING subjects in sandwich and part-time courses. Should be graduate in civil engineering and corporate member of appropriate professional institution. Teaching and/or industrial experience desirable.

Salary scale £738–£1,486. Point of entry and maximum dependent on training, qualifications and experience.

Application forms (foolscap s.a.e.) from the Secretary, returnable within 14 days. Please quote FE32/C/1853/8.

CUMBERNAULD DEVELOPMENT CORPORATION

The undernoted engineering staff are required for CUMBERNAULD NEW TOWN.

ENGINEERING ASSISTANT, GRADE C—for Structural group.

University graduate or graduate Inst.Struct.Eng. with some practical experience in reinforced concrete or structural steel design and/or construction.

The successful applicant will be engaged on design and supervision of construction of a wide range of reinforced concrete, prestressed concrete and steel structures, bridges, multi-storey buildings and factories.

Salary scale £815/£1,140 per annum. Placing according to experience.

Local Government Superannuation.

Five-days' week.

Assistance with housing in appropriate cases.

Write for application form to THE GENERAL MANAGER, CUMBERNAULD DEVELOPMENT CORPORATION, Cumbernauld House, Cumbernauld, Glasgow. Closing date for receipt of completed application forms: Monday, August 28th.

PRECAST PRESTRESSED and REINFORCED CONCRETE

DOW-MAC (PRODUCTS) LTD.

require

Design office staff in varying seniority up to £1,500 per annum salary scale. A wide variety of work gives opportunity for suitably qualified men to learn or develop the use of these materials. Situated in a country district, with free transport from nearest towns. Applications invited, in writing, to THE TECHNICAL DIRECTOR, Tallington, Stamford, Lincs.

FOR SALE.

HIGH-QUALITY FORKLIFT TRUCKS!!! PETROL, DIESEL AND ELECTRIC MODELS

By Coventry Climax, Conveyancer, Wingrove & Rogers, Lansing Bagnall, etc. From £450–£1000.

Full details on application. SPEED ELECTRICS, Dept. CCE., Church Street, Basford, Nottingham. Tel. 75716.

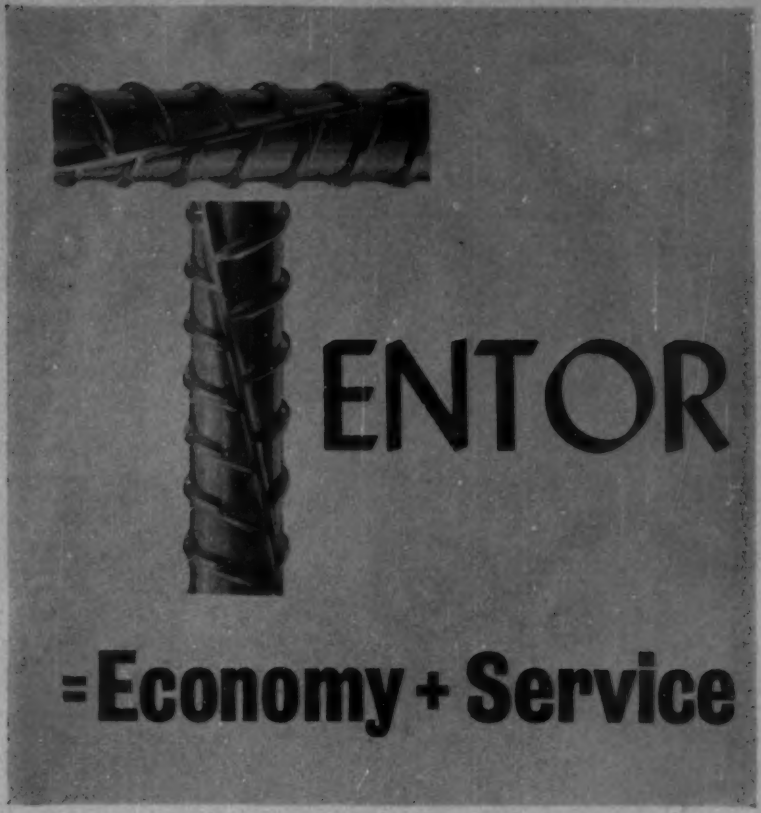
FOR SALE. Steel fencing stakes, chain link, etc. E. STEPHENS & SON LTD., Bath Street, London, E.C.1. Clerkenwell 1731.

"CONCRETE SERIES"

BOOKS ON CONCRETE

For a complete catalogue giving prices in sterling and dollars, send a postcard to :

CONCRETE PUBLICATIONS, Ltd.
14 Dartmouth St., London, S.W.1



Tentor can save up to 15% on costs—and up to 33⅓% on tonnage. Tentor delivery service is prompt. Tentor is available in cut lengths or bent to schedule requirements. Sizes ¼" to 1¼". Ask us for the Tentor handbook.

Technical enquiries to

THE TENTOR BAR COMPANY LTD

These companies and their branch offices supply Tentor Bars

B.R.C. STEEL LTD,
Silkmore Lane, Stafford. Stafford 444.

G.K.N. REINFORCEMENTS LTD,
GKN House, 22 Kingsway, London W.C.2. Chancery 1616.

McGALL & CO (SHEFFIELD) LTD,
P.O. Box 41, Sheffield. Rotherham 2076.

STEEL, PEECH & TOZER, LTD,
Branch of The United Steel Companies Ltd., The Ickles, Sheffield. Sheffield 41011.

GKN HOUSE, 22 KINGSWAY, LONDON W.C.2. TEL: CHANCERY 1616. GRAMS: TENTORED, WESTCENT, LONDON

FIRST-CLASS REINFORCED CONCRETE DETAILERS AND CIVIL ENGINEERING DRAUGHTSMEN

required by Consulting Engineers for wide range of work. Excellent salaries and prospects. Holiday arrangements honoured.

Write, stating age and full details of experience, to

HARRY BROMPTON & PARTNERS,
7–8 Hobart Place,
Grosvenor Gardens,
London, S.W.1.

LONDON COUNTY COUNCIL

BRIXTON SCHOOL OF BUILDING

Ferndale Road, London, S.W.4

require, as soon as possible

ASSISTANT GRADE B to teach CIVIL AND STRUCTURAL ENGINEERING subjects in sandwich and part-time courses. Should be graduate in civil engineering and corporate member of appropriate professional institution. Teaching and/or industrial experience desirable.

Salary scale £738–£1,486. Point of entry and maximum dependent on training, qualifications and experience.

Application forms (foolscap s.a.e.) from the Secretary, returnable within 14 days. Please quote FE32/C/1853/8.

CUMBERNAULD DEVELOPMENT CORPORATION

The undernoted engineering staff are required for CUMBERNAULD NEW TOWN.

ENGINEERING ASSISTANT, GRADE C—for Structural group.

University graduate or graduate Inst.Struct.Eng. with some practical experience in reinforced concrete or structural steel design and/or construction.

The successful applicant will be engaged on design and supervision of construction of a wide range of reinforced concrete, prestressed concrete and steel structures, bridges, multi-storey buildings and factories.

Salary scale £815/£1,140 per annum. Placing according to experience.

Local Government Superannuation.

Five-days' week.

Assistance with housing in appropriate cases.

Write for application form to THE GENERAL MANAGER, CUMBERNAULD DEVELOPMENT CORPORATION, Cumbernauld House, Cumbernauld, Glasgow. Closing date for receipt of completed application forms: Monday, August 28th.

PRECAST PRESTRESSED and REINFORCED CONCRETE

DOW-MAC (PRODUCTS) LTD.

require

Design office staff in varying seniority up to £1,500 per annum salary scale. A wide variety of work gives opportunity for suitably qualified men to learn or develop the use of these materials. Situated in a country district, with free transport from nearest towns. Applications invited, in writing, to THE TECHNICAL DIRECTOR, Tallington, Stamford, Lincs.

FOR SALE.

HIGH-QUALITY FORKLIFT TRUCKS!!! PETROL, DIESEL AND ELECTRIC MODELS

By Coventry Climax, Conveyancer, Wingrove & Rogers, Lansing Bagnall, etc. From £450–£1000.

Full details on application. SPEED ELECTRICS, Dept. CCE., Church Street, Basford, Nottingham. Tel. 75716.

FOR SALE. Steel fencing stakes, chain link, etc. E. STEPHENS & SON LTD., Bath Street, London, E.C.1. Clerkenwell 1731.

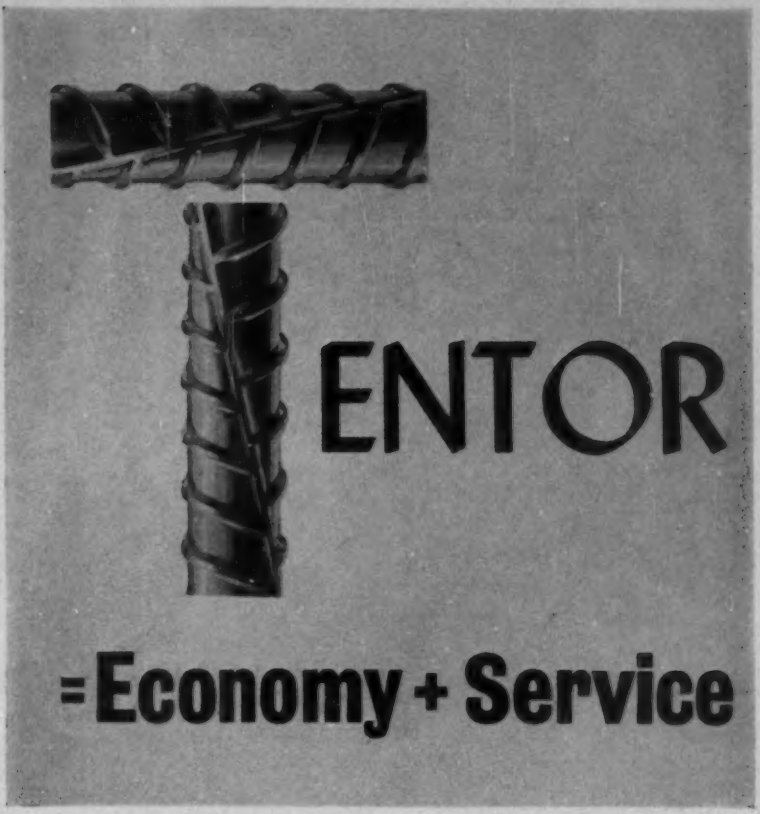
"CONCRETE SERIES"

BOOKS ON CONCRETE

For a complete catalogue giving prices in sterling and dollars, send a postcard to :

CONCRETE PUBLICATIONS, Ltd.

14 Dartmouth St., London, S.W.1



Tentor can save up to 15% on costs—and up to 33⅓% on tonnage. Tentor delivery service is prompt. Tentor is available in cut lengths or bent to schedule requirements. Sizes ¼" to 1¼". Ask us for the Tentor handbook.

Technical enquiries to

THE TENTOR BAR COMPANY LTD

These companies and their branch offices supply Tentor Bars

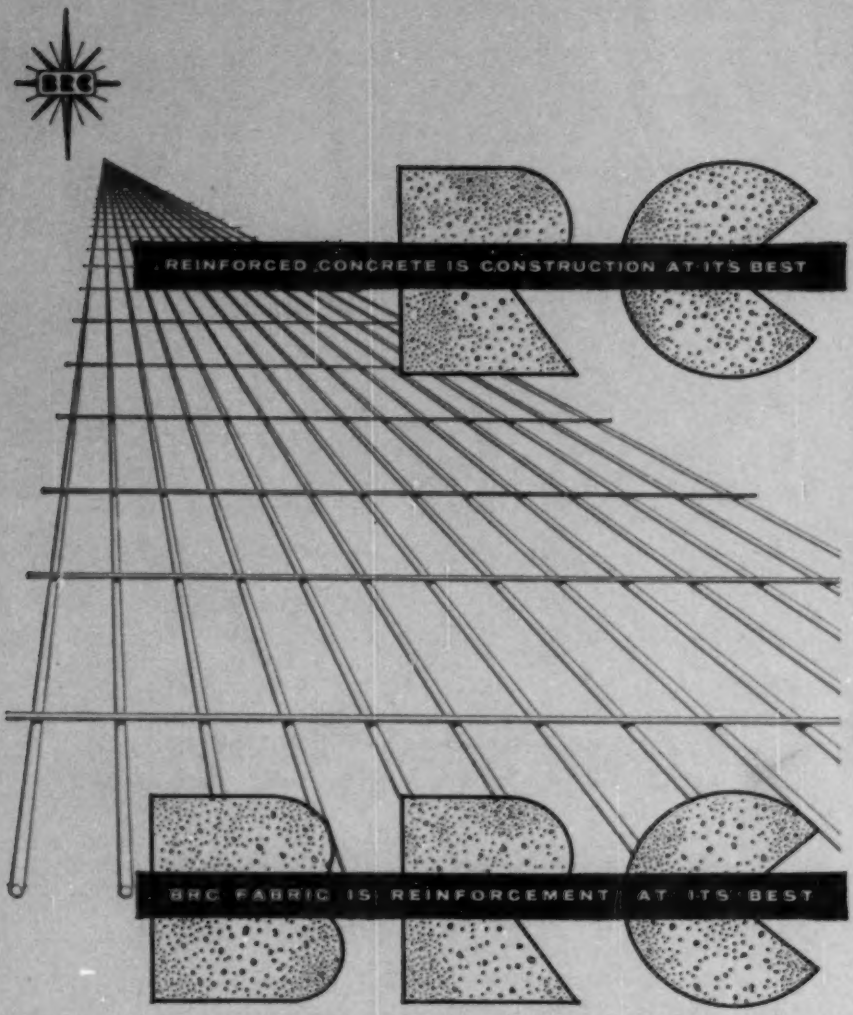
B.R.C. STEEL LTD,
Silkmore Lane, Stafford. Stafford 444.

G.K.N. REINFORCEMENTS LTD,
GKN House, 22 Kingsway, London W.C.2. Chancery 1616.

McCALL & CO (SHEFFIELD) LTD,
P.O. Box 41, Sheffield. Rotherham 2076.

STEEL, PEECH & TOZER, LTD,
Branch of The United Steel Companies Ltd., The Ickles, Sheffield. Sheffield 41011.

GKN HOUSE, 22 KINGSWAY, LONDON W.C.2. TEL: CHANCERY 1616. GRAMS: TENTORED, WESTCENT, LONDON



Specialists in Reinforced Concrete Design and Suppliers of Reinforcement

THE BRITISH REINFORCED CONCRETE ENGINEERING CO. LTD., STAFFORD

London, Birmingham, Bristol, Chelmsford, Leeds, Leicester, Liverpool, Manchester, Newcastle, Cardiff, Glasgow, Dublin, Belfast, Bulawayo, Calcutta, Johannesburg, Singapore, Vancouver

Export Sales: 54 Grosvenor Street, London W.1

Published by CONCRETE PUBLICATIONS LTD., 14 Dartmouth Street, London, S.W.1. Telephone: Whitehall 4581
Printed by BUTLER & TANNER LTD., The Selwood Printing Works, Frome and London